June 1990
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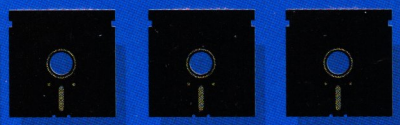
Just for your Tandy Color Computer 1,2 and3

The RAINBOW®

THE COLOR COMPUTER MONTHLY MAGAZINE

Shades of CoCo



Hardware
Games
OS-9

Plus: a look at *Those Darn Marbles*

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Sinistaar

Sundog Systems proudly presents the first 512K arcade game available for your CoCo III! If you don't have 512K, you will want to get it just for this game! The evil Sinistaars have invaded the galaxy and it falls to you to destroy them. These fiends will attempt to hold you with a constant barrage of drone ships while they muster their strength, and eventually find and obliterate you. Your mission is to mine the myriad asteroids in search of the precious ore which can be refined into sinibombs, your only weapon against the Sinistaars. Many surprises await as you advance through the increasingly difficult stages. Experience the fast-paced action of 512K packed with spectacular graphics, sound effects, and voices! Dozens of stages will keep you coming back for more. Req. 512K CoCo III and disk drive.

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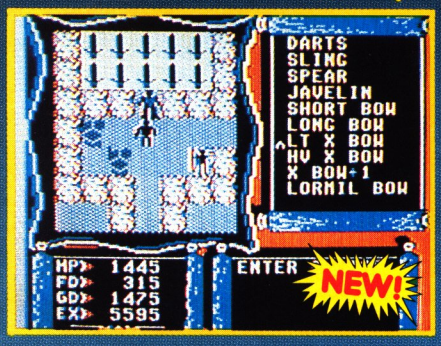

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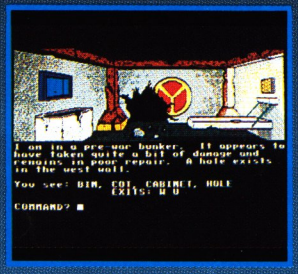

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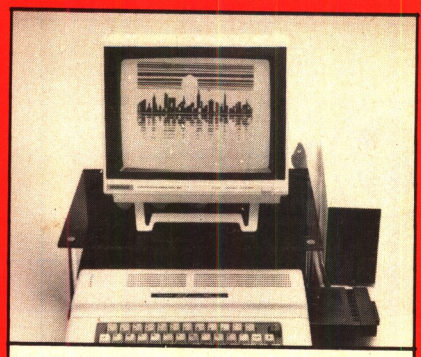

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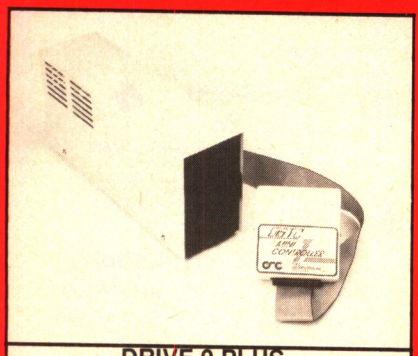

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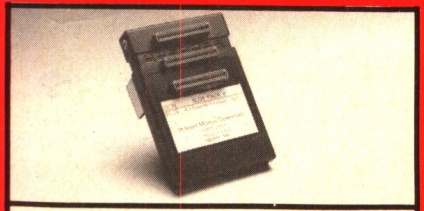

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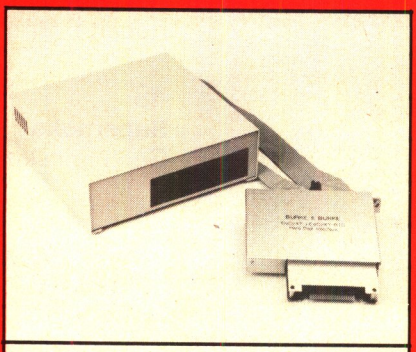

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See Rainbow Reviews 8/89

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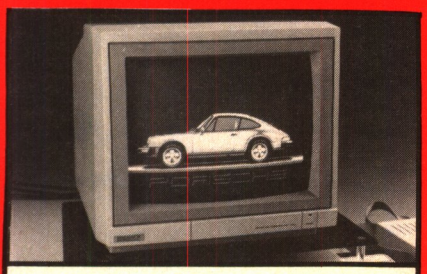

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RAINBOW

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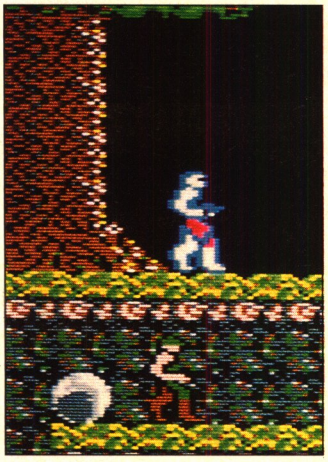

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"BASICally Speaking" and "Wrapping The Rainbow" will return next month.

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Letters to the RAINBOW

Addition to Disk Copy Utility

Editor:

If you add the following lines to Mr. Medlock's "Disk Copy Utility" on Page 31 of the January 1990 issue, the program overwrites files on request. This only works on the CoCo 3, which has built-in error-trapping capability. The ONERR command is placed at the beginning to trap all errors. Other errors that can be trapped in this program are Error 28, Disk Full or Error 30, Write-Protected. Error code numbers are listed in the CoCo 3 Extended BASIC and Disk System manuals.

```
20 'CATCH ANY ERROR
25 CLS:ONERR GOTO 320
320 'CATCH FILE ALREADY EXISTS E
RROR
330 IF ERNO=33 THEN PRINT"FILE A
LREADY EISTS"
340 PRINT"REWRITE? (Y/N)?"
350 'CHECK FOR ANSWER
360 N$=INKEY$:IF N$=""THEN360
370 IF N$="N" OR N$="n" THEN GOT
O 310 ELSE IF N$="Y" OR N$="y"
THEN PRINT"DELETING",NAME$+":1"
380 'IF YES, DELETE THE FILE ON
DRIVE ONE
390 KILL NAME$+":1":ENTRY=ENTRY:
GOTO180
```

John A. Coldwell
Prince Rupert, British Columbia
Canada

CoCo Forecast

Editor:

I found your March 1990 editorial interesting and exciting, especially when read in context of the announcement made on Page 25 by Kenneth Leigh Enterprises. I am sure most of us are eagerly anticipating what is about to happen.

One of the fascinating observations I've made regarding the CoCo is the community itself. The community has decided to forge ahead. Many CoCo users have in mind to build a successor to the CoCo 3 that we'll support ourselves. That spirit has been alive and well ever since the release of OS-9 Level 2.

Some changes are in store for us. It seems pretty certain that in order to expand our software and experience base, we need to embrace OSK. For those of us willing to accept change and true progress, this should prove to be no obstacle.

It looks like we are going to get our chance to see what some computer enthusiasts can do. I don't know of any group that has developed their own machine, and I have no idea what the future holds for us, but I don't believe it's going to be boring.

Wayne Montague
Mississauga, Ontario
Canada

O or 0?

Editor:

Two problems occur with your new listings. A magnifying glass is required to read them and it is impossible to differentiate between the 0 and O. In the one-liners of January 1990, I could not run many of them because it was impossible to tell whether they were O or 0. Those familiar with programming can differentiate between some of them but not all without long testing. It's a real inconvenience. Why don't you replace the letter O with a sign such as a diamond; then anyone could tell which is which?

I'd also like to bring up another point. More and more the magazine allocates space to OS-9 and machine language, leaving the majority of readers with what is left, which is becoming less and less. Of course OS-9 and machine language are the future, but they unfortunately are impossible to comprehend even with the articles.

What is lacking in the magazine is a series of articles on advanced programming in BASIC. Most readers are familiar with the Color BASIC manual; however, it does not contain anything on advanced programming in BASIC.

THE RAINBOW was running an interesting article called "Do-It-Yourself Database," by Richard Perlman, but it has never been completed. Other writers present interesting programs but these are limited. Never do we find a structured series on advanced programming for those interested in more than the amateur projects.

Armand Belanger
Laval des Rapides, Quebec
Canada

The zeroes in RAINBOW listings are slashed to help you differentiate them from the letter O. Because of the way the One-Liners feature in the January issue was

The Rainbow

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Cover illustration by Heidi Nelson

created, we were not able to do this.

Part 4 of "Do-It-Yourself Database" appears in the May 1990 issue and the last installment is scheduled to appear in July.

Serial Joysticks?

Editor:

I have a CoCo 2 and am wondering if it is possible to use joysticks by plugging them into the serial and cassette ports using special adapters and commands.

James Donegan
14 Hemlock Lane
Saugerties, NY 12477-2110

The joysticks must be plugged into the two joystick ports. They will not work in the serial and/or cassette ports without extensive hardware and software modifications.

Come Out of the Closet, CoCo

Editor:

I'm looking to buy a Tandy Color Computer 2 (16, 32 or 64K) with or without Extended BASIC. If you've got one in your closet (preferably unmodified and working), call me at (301) 490-1996. I'm also interested in locating lower-kit boards that give the old CoCo 2 true lowercase letters.

Alfredo Santos
1216 Shadetree Lane
Laurel, MD 20708

Rainbow Database

Editor:

After years of collecting RAINBOW and RAINBOW ON TAPE/DISK, I have so many programs I can't keep track of them. It would be wonderful if someone could set up a database of RAINBOW programs to date. Could this be one of your anniversary surprises?

Steve Ostrom
Minnetonka, Minnesota

Well, we do publish a yearly index of articles. But a complete databased index to RAINBOW ON TAPE/DISK? Now that's an idea we'll look into.

Sagging Support

Editor:

I have been a subscriber to your magazine for several years. I'd like to express my concern over the lack of support displayed by some of your contributors. It seems that even though the authors solicit comments on their work and imply a willingness to engage in correspondence with those who write (SASE enclosed), some of them have been extremely negligent by ignoring my pleas for help.

On four separate occasions I have written letters to contributors at the addresses given, enclosed the SASE, explained my needs and then trusted that they would afford me the courtesy of a rapid reply. I'm afraid that hasn't happened.

James R. Vann
Elmwood, Connecticut

We are sorry to hear you got no response. We do all we can to encourage our contributors to respond. And your sending an SASE can help. But sometimes even that is not enough.

Morse Detector

Editor:

In the May '89 RAINBOW reader Dwayne Fitzgerald (a ham radio operator) asked if there is any way to use a CoCo 1, 2 or 3 to decode Morse code. I read this in your "BASICally Speaking" column.

I am aware of one such interface made specifically for the CoCo 1, 2 and 3. This unit is made and sold by Dynamic Electronics, P.O. Box 896, Hartselle, AL 35640.

This unit uses an interface cable that hooks to the cassette port and one joystick port. It sells for $39.95 complete, or $19.95 program only, and you build your own interface.

Tom Harvey
New Hampton, Iowa

Natural Respect

Editor:

I was appalled when I read through the April 1990 issue of THE RAINBOW and came across the program *Steady Aim Fire* by Kathy Rumpel. The program has the user shoot at birds on a telephone wire with a BB gun.

As a biology teacher, one of the goals I have is for all my students to develop a respect for living things. I feel the inclusion of this program in your magazine was in very poor taste. I certainly don't want my students using a program that encourages this type of activity and have deleted this program from the disk. I hope that in the future THE RAINBOW will think twice before publishing a program of this nature.

Bob Teague
Winthrop High School
Winthrop, Maine

Cousin CoCo

Editor:

Because of the atmosphere created by THE RAINBOW, the CoCo has become more a part of the family than just an appliance.

There are some great programs for the CoCo that are powerful, friendly and affordable. This makes the CoCo a hobby rather than a dollar sink.

What I'm looking for in your magazine is an update of WEFAX to make it receive phone line FAX messages; a review of the Hewlett Packard DeskJet Plus printer; and a MAX-10 type emulator for a spreadsheet and database.

Bill Palmer
Port Elgin, Ontario
Canada

Need a *Try-o-Tax* Tip

Editor:

Is there a computer program that will let me store tax records on disk?

I have the 1986 version of *Try-o-Tax*, but it needs a yearly upgrade to work. It can't be saved to disk, which is what I'm looking for so I can have more orderly record keeping of tax records. I've seen a program from Puritas Springs Software that saves it to disk, but I still need a yearly upgrade in order for it to work. Is there such a program available?

I have *DeskMate 3* for the Color Computer 3. I really don't want to put anymore money into the CoCo 3. If I can't do this using the CoCo 3, I'll have to move up to the Tandy 1000 HX, SL or TL.

Theodore Schultz, Jr.
963 Lincoln Drive East
West Bend, WI 53095

Yearly updates are required for tax programs because of the yearly changes in tax laws. Of course, you may devise a means of storing your tax info using the DeskMate 3 *spreadsheet.*

To the Rescue!

Editor:

Many thanks to Howard Medical for sending me the disk drive power connector I had dropped at its booth at the recent RAINBOWfest in Chicago. A few days after the show, I was installing the drive I had purchased from them when I realized the connector was missing. I searched all over (I even cleaned out the car in the process) but I couldn't find the connector. Two days later, I received the connector in the mail along with a note from Howard Medical. It's the little things like this that make buying CoCo stuff a real pleasure.

James Hawerbier
Elmhurst, Illinois

A Just Response

Editor:

Recently, the *Tetris* ROM pak I bought in March '89 developed a problem and would no longer function. I took it to the local Radio Shack Computer Center for assistance. They were not able to help me, so I bought another one.

Determined that it was not my fault, I decided to write to Radio Shack in Fort

CIII Pages

by Walter Bayer

The *ultimate* **desktop publishing** program for the CoCo 3. Pull-down menus, icons & dialog boxes, drawing tools (create boxes, polygons, rays, circles, ellipses, brush shapes), cut, copy, stamp, paste, zoom, flip, enlarge/reduce, rotate, stretch, undo, import any ASCII text, 2/3 columns & page preview. Includes 14 fonts & 60 pieces of clip art. Req. CoCo 3, RGB/ Monochrome Monitor, Min 1 drive, Tandy Hi-Res Interface, Joystick/mouse & DMP 105/106/Epson/Gemini & Compatible Printer. Only **$49.95**. w / Hires Inteface Only **$59.95.**

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UPS 2ND DAY AIR

Worth. I didn't expect a response and the one I got was very gratifying. Tandy agreed that I should just be charged a replacement fee instead of the full price and so refunded the difference to me.

Paul Yelk
Montgomery, Alabama

A Toot of the Horn

Editor:

We have recently had a very pleasant experience with one of RAINBOW's advertisers, Rulaford Research of San Diego, California, and would like to share it with other readers.

Late last fall we wrote Mr. Cecil Houk of Rulaford Research, inquiring about some problems we were experiencing with an early version of *Lyra*. We purchased the program from Speech Systems, a now-defunct company, well before Rulaford Research even began distributing it. Not only did Cecil respond, but he did so via a phone call. He provided us with much valuable advice, and assisted us in locating an affordable MIDI-capable synthesizer. We are now enjoying a vastly-improved version of *Lyra* and enjoying it much more, thanks to Cecil.

Chuck and Greg Baker
Salem, Oregon

Serial Drivers

Editor:

I am looking for the source code for the equivalent of the `COM #X` command to use for interfacing lab equipment with our Color Computer via an RS-232 Pak. Can anyone provide me with this information?

Christopher E. Elhardt
Department of Chemistry
Baylor University
Box 7348
Waco, TX 76798-7348

THE RAINBOW welcomes letters to the editor. Mail should be addressed to: Letters to Rainbow, The Falsoft Building, P.O. Box 385, Prospect, KY 40059. Letters should include the writer's full name and address. Letters may be edited for purposes of clarity or to conserve space.

Letters to the editor may also be sent to us through our Delphi CoCo SIG. From the CoCo SIG> prompt, type RAI to take you into the Rainbow Magazine Services area of the SIG. At the RAINBOW> prompt, type LET to reach the LETTERS> prompt and then select Letters for Publication. Be sure to include your complete name and address.

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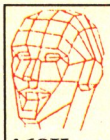

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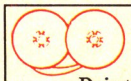

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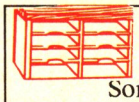

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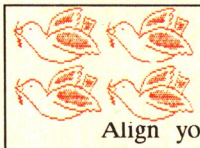

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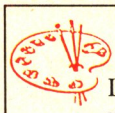

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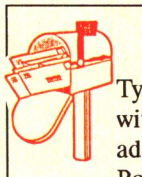

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Type a letter, follow it with a list of names & addresses and have Word Power print out personalized letters. Its that easy!

SAVING / LOADING

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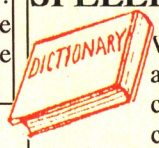

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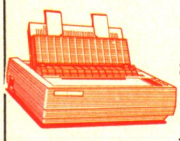

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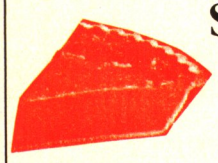

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UPS 2ND DAY AIR

Let Us Entertain You

Since the subject of this June issue is Entertainment and so many of us became interested in the CoCo because we wanted to be entertained in some way, it is appropriate for me to talk about the CoCo and its value to you right now.

What has always amazed me is the great rush and panic many of us seem to feel about *new* and *better* and *more* in the computer world. Indeed, the only thing comparable to the new-computer itch is the new-car itch. You know, the new models are out and you just gotta shop. If you don't think this is true, look at a September issue of, say, *Sports Illustrated* and notice the number of automobile advertisements vis-a-vis other advertising.

Around the 1950s there was a great hue and cry about planned obsolescence. This was particularly directed at automakers charged with making changes in their product on a yearly basis just so people would buy them, even if they did not need to do so. Hue and cry to the contrary, automakers still do this to an extent.

Computer manufacturers generally do not have to worry about planning obsolescence. In an industry that really is (to use another cliche) on the cutting edge of technology, things change so fast that the latest thing in the morning may be old hat by afternoon. We get caught up in it, and we shouldn't.

The Color Computer you are using today is a perfect example. For whatever purposes you plan to use a computer, a Color Computer can serve them so well that it would simply boggle the mind of people who in the late '50s and early '60s laid out in excess of $1 million for a room-sized behemoth that took high-priced techtypes in white lab coats to operate. Whether you wanted to write letters, publish newsletters, move figures around and play "what if," communicate across the continent, or just simply be entertained, an original CoCo with 64K, Extended Color BASIC and a tape recorder for mass storage was a vastly superior machine to an IBM- or UNIVAC-whatever mainframe of that era.

Since the theme of this month's RAINBOW is entertainment, let's consider entertaining ourselves with a computer. In a truly significant achievement of programming and imagination, the game *Adventure* appeared on a mainframe one day, written in FORTRAN. Will Crowther and Don Woods wrote it and it took thousands of lines of code, was entered originally with punchcards, and probably cost tens of thousands of dollars in computer time to develop.

Yet it was a simple game, a text Adventure. The games in the *Rainbow Book of Adventures* series are, on the whole, far more complex and more entertaining. Many of them are graphics Adventures, as are the vast majority of the Adventure programs available commercially. These are so far beyond the scope of a huge mainframe it boggles the mind.

All of this is by way of saying that your present Color Computer, be it an original, a CoCo 2 or a CoCo 3, most likely has far more power than you can possibly use. For the vast majority of applications, there is something swifter and neater available on another computer system, but it really is all relative.

If you can write your letters, school papers, reports, columns and the like with a word processor on the CoCo, why, exactly, do you need another computer? I am willing to bet the CPU in your CoCo is always waiting for you to input information; it is merely relative as to whether you need something more.

For those of you who do, technically speaking, there are options available through third parties that give you a "CoCo 4" environment. The obvious advantage to this is that these options allow you to move to new frontiers while staying within the CoCo area. For those of you not so technically inclined, a non-Tandy upgrade path gives you something to consider as you look at future needs.

It is interesting: Two of the sensations last year in the MS-DOS market were *Ami* and *Word for Windows*, which use the graphics environment of Microsoft *Windows* to show formatting on-screen for word processing. Howard Cohen's *Telewriter* did that so many years ago I have lost count. And *Telewriter* still does it faster.

* * * * *

Val Burke of Red Oak, Georgia, writes to point out that I erred in proclaiming 1990 as the "beginning of the new decade" in the March issue. Val points out the Latin numbering system we use started with the year A.D. 1, not A.D. 0; thus, 1991 is the proper start of the "new decade."

Val is right and the same goes for the new millennium, which will really begin with 2001 rather than 2000.

Whichever year you choose to celebrate (I predict most of us will opt for both), I predict your CoCo will still be useful to you then.

— Lonnie Falk

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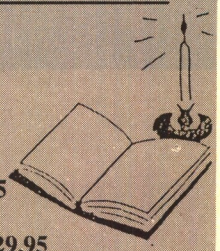

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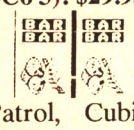

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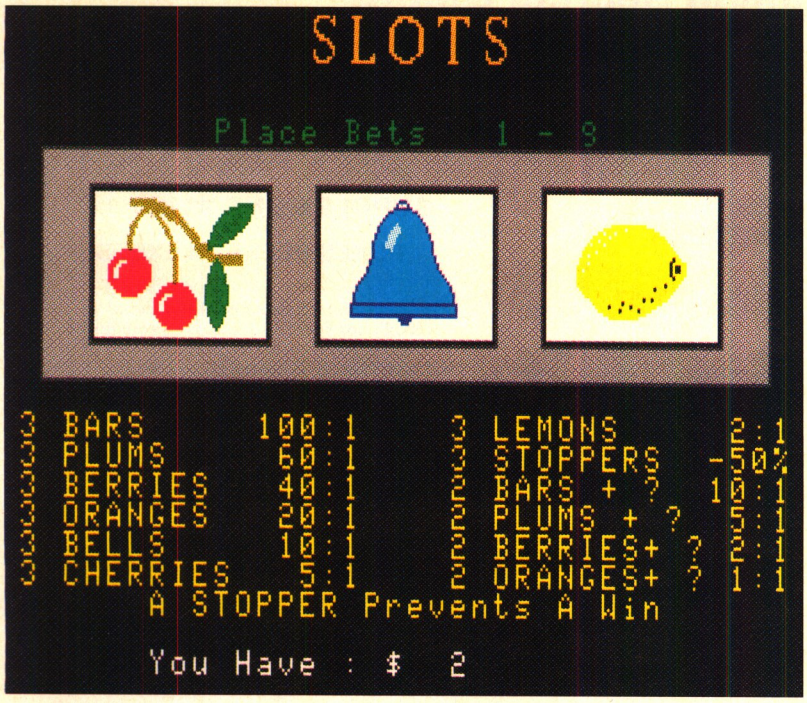

A slot machine game for the CoCo 3

VEGAS at Your Fingertips

by John Mosley

Many people like playing slot machines but nobody likes losing money to them. *Slots* is a compromise. It simulates a real slot machine on a 128K CoCo 3 and doesn't require real money to play.

The main portion of the program is written in BASIC, but there is a machine language subroutine built in to create a smooth, realistic effect. There are eight 16-color symbols: cherries, oranges, bars, plums, bells, strawberries, lemons and stoppers. You can bet from one to nine dollars and win up to 100 times what you've bet. However, if you get even one stopper (the circle with a slash), you don't win anything; if you get three stoppers, you lose half of everything you have.

To play the game, type in the listing, save it and run it. Be sure to save it before running it, because a mistake in a data statement can crash the computer. After you run SLOTS, you are asked what kind of a monitor you have. Then you are able to play. When you get to the playing screen, the amount of money you have determines your maximum bet. However, the program requires all bets to be between $1 and $9. You will always have at least two dollars.

After the wheels spin around a few times, the machine comes to a stop. Various ways to win and the payoffs for each winning combination are listed on the screen. The computer then adds what you've won to your score, and you can bet again. Enjoy *Slots* — it's a lot of fun to play, and you don't lose any money!

❑

John Mosley, a junior at Portland High School, enjoys programming games, especially those using sound and graphics. He can be contacted at 420 Main St., Portland, CT 06480. Please include an SASE when requesting a reply.

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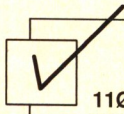

```
110 ..... 0      490 ..... 21     1020 ..... 150
140 ..... 32     530 ..... 208    1120 ..... 164
180 ..... 109    580 ..... 135    1210 ..... 45
240 ..... 52     620 ..... 79     1270 ..... 54
260 ..... 141    650 ..... 243    1360 ..... 186
300 ..... 69     670 ..... 128    1440 ..... 27
330 ..... 92     750 ..... 179    1550 ..... 116
370 ..... 250    800 ..... 16     END ..... 253
410 ..... 207    850 ..... 169
450 ..... 19     930 ..... 233
```

The Listing: SLOTS

```
0 ' COPYRIGHT 1990 FALSOFT, INC
10 ' SLOTS
20 ' COPYRIGHT 1989
30 ' BY: JOHN MOSLEY
40 POKE65497,0
50 PCLEAR7
60 FORT=&HF00 TO &HF00+78
70 READ A$
80 A$="&H"+A$
90 POKE T,VAL(A$)
100 NEXTT
110 DATA 86,31,B7,FF,A2,8E,10,00
,10,8E,40,96,8D,18,8E,10,00,10,8
E,40,C0,8D,0F,8E,10,00,10,8E,40,
EA,8D,06,86,7A,B7,FF,A2,39,4F,CE
,00,00,E6,84,E7,A4,30,01,31,21,4
C,81,20,26,F3,4F,33,41
120 DATA 31,A9,00,80,11,83,00,28
,27,0A,8C,38,00,26,E2,8E,10,00,2
0,DD,39
130 CLS
140 PALETTE12,0:PALETTE13,18:INP
UT"  MONITOR TYPE:
          0 - COMPOSITE
          1 - RGB
    ";M:FORT=0 TO 15:PALETTET,0
:NEXTT
150 HSCREEN2
160 POKE&HF06,&H33:POKE&HF07,0:P
OKE&HF0F,&H33:POKE&HF10,0:POKE&H
F19,0:POKE&HF2B,&HA4:POKE&HF2D,&
H84
170 Z=1:FORQ=&H10 TO &H33 STEP &
H5
180 POKE&HF18,Q
190 HCLS0:ON Z GOSUB 230,290,340
,400,440,470,530,600
200 EXEC &HF00
210 Z=Z+1:NEXTQ
220 POKE&HF2B,&H84:POKE&HF2D,&HA
4:HCLS15:GOSUB640:GOTO 820
230 ' CHERRIES
240 HDRAW"C13BM224,67;U3RND3U3FD
U3FU2RURUR2HR5GLFRDRDRDRD2ED2RD4
UED10RU7":HDRAW"BM225,54;R9DNL9R
3DNL6R2GNL5R4DNL4RFNL5FNL3FNL2FN
L2RFNL3FNL3DL2RFLR4FL5FR5DNL4R11
DNL12DNL9"
250 HDRAW"C1BM222,68;R5FRF3D4G3L
GL5HLH3U4E3RE":HPAINT(222,70),1,
1:HDRAW"BM239,77;R5FRF3D4G3LGL5H
LH3U4E3RE":HPAINT(239,79),1,1:HD
RAW"C0BM219,75;U2RND2URUR2":HDRA
W"BM236,84;U2RND2URUR2"
260 HDRAW"C8BM254,67;RER3ERERE2R
E3UEU2L5GL2GLG4DGDGD2":HPAINT(26
0,60),9,8:HDRAW"C8BM257,64;U2F2L
UER3HLUFER3HLUFEUFE":HDRAW"BM257
,70;F2DFD2FD5GD2GDG2H2UHU2HU5EU2
EUE2":HPAINT(257,72),9,8
270 HDRAW"BM257,73;DNF2NG2D3NF2N
G2D3NF2NG2D3NFNGD3"
280 RETURN
290 ' ORANGE
300 HDRAW"C7BM237,56;R12FR2FRF7D
FD8GDGDGDG4LGLGL2GL9HL3HLHLH5UHU
HU8EU2EUE4RERERE":HPAINT(237,58)
,7,7:HDRAW"C11BM230,65;DFU3ED3EU
3ED3EU2ED2RU2RDBR21BD7C15LG2D2F2
RBU2U2RD2"
310 X=230:Y=81:FORT=1 TO 26:READ
 A,B:X=X+A:Y=Y+B:HSET(X,Y,15):NE
XTT
320 DATA 0,0,4,1,-2,1,4,1,3,-2,0
,3,2,-2,1,2,-2,2,4,0,-2,-2,3,0,-
1,-4,3,-1,1,2,1,1,-1,2,2,0,2,-2,
-1,-2,2,-2,2,1,-1,3,3,-5,1,1,1,-
3
330 RETURN
340 ' BAR
350 HCOLOR8:HLINE(216,58)-(271,8
5),PSET,BF:HCOLOR9:HLINE(219,60)
-(268,83),PSET,BF:HDRAW"C10BM272
,59;D27L55":HDRAW"BM226,77;U3NR5
BU5U3R5BR5BDD3GDFD5G3NL9BR5R2U3E
U3R5BU5BL3U2RBR4BDDFD2FD3FD4NL2B
R2R2U7R4BU5BL4U3R5BR5D4G2DFDFD5L
2"
360 HDRAW"C8BM223,80;R10E2U5HUEU
5H2L10D17E2R6E2UH2L6ND5BU3R6E2UH
2L6D5":HPAINT(224,72),8,8
370 HDRAW"BM237,80;U3EU3EU2EU2EU
E2RF2DFD2FD2FD3FD3L2U2HU3HL5GD3G
D2L2BU10BR5R3U3HLGND3U2FU2RD2ED2
":HPAINT(242,72),8,8
380 HDRAW"BM252,80;U17R10F2D5G2D
FDFD4L2U3HUH2L5D7L2U10BR2R6E2UH2
L6D5":HPAINT(257,72),8,8
390 RETURN
400 ' PLUM
410 HDRAW"C2BM242,66;L3GLGLG4DGD
GD3FDFDF4RFRFR9ERERE4UEUEU3HUHUH
4LHLHL3GL":HPAINT(242,77),2,2:HD
RAW"C0BM234,73FU2FU2FU2FUFU2F":H
DRAW"C12BM254,55;L5GLG3D3LD4RU4R
U3RURURUR6"
420 HDRAW"C8BM244,61;LU2H2L2HL10
G2F2R2DR2FR2FR4ER2U2":HPAINT(234
,58),9,8:HDRAW"BM241,60;L2NG2UNH
L2NH2NG2L3NGNH2L3HL"
430 RETURN
440 ' BELL
450 HDRAW"C3BM224,85;R38U3HU2HUH
4HUHUHU3HUHUH4LHNL6H2L2G3LG4DGDG
D4GDGDG4DGD2GD3":HPAINT(241,70),
4,3:HDRAW"BM224,82;R38D3L17DL4FR
2":HDRAW"C5BM236,66;RFUHLR3UL2UR
3UL2R3UL2E"
460 RETURN
470 ' STRAWBERRIES
480 HDRAW"C1BM223,63;D2GDGDGD6FD
FDF3R6ERE2UEUEUEU7HU4L15":HPAINT
(231,70),1,1:HDRAW"BM247,66;D2GD
4GD6FDF2R2FR6ERE3UEU3EU5HUHUH3L8
G4":HPAINT(251,75),1,1
490 HDRAW"C8BM240,64;L6NHD5HUH2U
HLD2GD2GHU5L2GL4ERE2RER9F2RFRFBR
5BD3R2E2R2EFD4FND2EU5DF3DF3U5HU3
F2RFRFR2HLUH3LHL10G6":HPAINT(255
```

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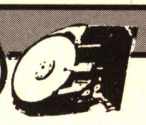

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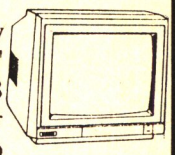

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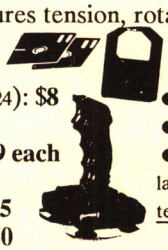

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```
,62),9,8:HPAINT(231,62),9,8
500 X=224:Y=69:FORT=1 TO 30:READ
 A,B:X=X+A:Y=Y+B:HSET(X,Y,15):NE
XTT
510 DATA 0,0,-2,3,4,0,-2,2,2,3,-
1,3,4,-1,0,-4,0,-5,2,8,2,-4,-1,-
3,4,0,-1,-6,17,4,-2,3,3,0,-1,3,-
3,2,2,3,4,-1,1,4,0,-7,0,5,1,-3,-
1,-3,-1,-4,2,2,2,2,1,2
520 RETURN
530 ' LEMON
540 HDRAW"C11BM263,70;D3G7LGLGLG
LGL2GL10HLHLH4LH3U5EUEUE4RERER2E
R12FR2FRFRF8":HPAINT(244,64),11,
11:HDRAW"C15BM261,71;DLUBU2BLGD3
F"
550 X=225:Y=72:FORT=1 TO 11:READ
 A,B:X=X+A:Y=Y+B:HSET(X,Y,0):NEX
TT
560 DATA 0,0,2,-2,0,-2,3,-1,-2,-
2,5,0,-2,-1,4,-1,-2,-1,4,0,4,-1
570 X=235:Y=82:FORT=1 TO 9:READ
A,B:X=X+A:Y=Y+B:HSET(X,Y,15):NEX
TT
580 DATA 0,0,4,1,1,-2,3,1,3,1,2,
-3,3,0,1,-3,4,-1
590 RETURN
600 ' STOP
610 HDRAW"C6BM238,55;R10FR2FRFRF
5DFDFD9GDGDG5LGLGL2GL10HL2HLHLH5
UHUHU9EUEUE5RERER2EBD4R10FR2FRFG
LG2LG2LG2LG3LG2LG2LG3HUHU9EUE4RE
R2E":HDRAW"BM256,64;G3LG2LG2LG2L
G2LG3LG2LGFRFR2FR10ER2ERE4UEU9HU
H"
620 HPAINT(241,57),6,6:HDRAW"C14
BM229,76;U9EUE3RER2ER10BR8BD5G3L
G2LG2LG2LG2LG3LG2LBD8BR7R8ER2ERE
RE6UEUEU7"
630 RETURN
640 HCLS15:HCOLOR14:HLINE(42,50)
-(109,93),PSET,B:HLINE(126,50)-(
193,93),PSET,B:HLINE(210,50)-(27
7,93),PSET,B:HLINE(24,40)-(295,1
03),PSET,B:HPAINT(26,42),6,14
650 HCOLOR11:HPRINT(2,14),"3 BAR
S     100:1":HPRINT(2,15),"3 PLU
MS      60:1":HPRINT(2,16),"3 BER
RIES    40:1":HPRINT(2,17),"3 ORA
NGES    20:1":HPRINT(2,18),"3 BEL
LS      10:1":HPRINT(2,19),"3 CHE
RRIES    5:1":HPRINT(22,14),"3 LE
MONS      2:1"
660 HPRINT(22,15),"3 STOPPERS  -
50%":HPRINT(22,16),"2 BARS + ?
10:1":HPRINT(22,17),"2 PLUMS + ?
  5:1":HPRINT(22,18),"2 BERRIES+
 ? 2:1":HPRINT(22,19),"2 ORANGES
+ ? 1:1":HPRINT(8,20),"A STOPPER
 Prevents A Win"
670 HCOLOR9:HPRINT(11,4),"Place
Bets   1 - 9":HCOLOR0:HPRINT(8,2
2),"You Have : $"
680 DIM N$(4)
690 N$(1)="BL8R3GND11LD11LR8U2G2
"
700 N$(2)="BL4L5FL2DLGND6RD7RDR2
DR4URERENU6LU7LUL3"
710 N$(3)="D2H2L4DLD3RDR2GR3DRDR
D2GLDL4ULU2"
720 N$(4)="D2HUL10D2E2R3D12LR3LU
12"
730 HDRAW"C7BM165,4;"+N$(2)
740 HDRAW"BM147,4;"+N$(1)
750 HDRAW"BM132,4;"+N$(3)
760 HDRAW"BM182,4;"+N$(4)
770 HDRAW"BM196,4;"+N$(3)
780 GOSUB1520:RETURN
790 IF M=0 THEN PALETTE0,63:PALE
TTE1,7:PALETTE2,9:PALETTE3,11:PA
LETTE4,28:PALETTE5,60:PALETTE6,3
2:PALETTE7,37:PALETTE8,17:PALETT
E9,33:PALETTE10,1:PALETTE11,51:P
ALETTE12,5:PALETTE13,20:PALETTE1
4,16:PALETTE15,0
800 IF M=1 THEN PALETTE0,63:PALE
TTE1,36:PALETTE2,45:PALETTE3,9:P
ALETTE4,25:PALETTE5,59:PALETTE6,
56:PALETTE7,52:PALETTE8,16:PALET
TE9,18:PALETTE10,2:PALETTE11,54:
PALETTE12,34:PALETTE13,48:PALETT
E14,7:PALETTE15,0
810 RETURN
820 ' MAIN ROUTINE
830 POKE&HF06,&H10:POKE&HF0F,&H1
0:POKE&HF18,&H10:EXEC&HF00:GOSUB
790
840 X=&H1000:Y=&H1000:Z=&H1000:S
=2
850 I$=INKEY$:IF I$="" THEN 850
860 I=VAL(I$):IF I=0 THEN 850
870 IF I>S THEN SOUND1,2:GOTO 85
0
880 SOUND100,1:S=S-I:GOSUB1520
890 PLAY"V31O1T20L40;CDEFGABCDEF
GABCDEFGABCDEFGABCDEFGABCDEFGABC
DEFGAB"
900 E=RND(-TIMER):E=INT(RND(8)):
F=INT(RND(8)):G=INT(RND(8))
910 FORT=1 TO 32
920 X=X+&H280:Y=Y+&H280:Z=Z+&H28
0
930 GOSUB1540:NEXTT
940 J=(E-1)*&H500+&H1000:K=(F-1)
*&H500+&H1000:L=(G-1)*&H500+&H10
00
950 E=E+1:F=F+1:G=G+1
960 IF E=9 THEN E=1
970 IF F=9 THEN F=1
980 IF G=9 THEN G=1
990 IF X=J THEN 1000 ELSE X=X+&H
280:Y=Y+&H280:Z=Z+&H280:GOSUB154
0:GOTO 990
1000 FORT=1 TO 2
1010 X=X+&H140:Y=Y+&H280:Z=Z+&H2
80:GOSUB1540
1020 NEXTT
1030 FORT=1 TO 3
1040 X=X+&HA0:Y=Y+&H280:Z=Z+&H28
0:GOSUB1540
1050 NEXTT
1060 FORT=1 TO 5
1070 X=X+&H20:Y=Y+&H280:Z=Z+&H28
0:GOSUB1540:NEXTT
1080 FORT=1 TO 16
1090 Y=Y+&H280:Z=Z+&H280
1100 GOSUB 1540
1110 NEXTT
1120 IF Y=K THEN 1130 ELSE Y=Y+&
H280:Z=Z+&H280:GOSUB1540:GOTO 11
20
1130 FORT=1 TO 2
1140 Y=Y+&H140:Z=Z+&H280
1150 GOSUB1540:NEXTT
1160 FORT=1 TO 3
1170 Y=Y+&HA0:Z=Z+&H280:GOSUB154
0:NEXTT
1180 FORT=1 TO 5
1190 Y=Y+&H20:Z=Z+&H280:GOSUB154
0:NEXTT
1200 FORT=1 TO 16
1210 Z=Z+&H280:GOSUB1540:NEXTT
1220 IFZ=L THEN 1230 ELSE Z=Z+&H
280:GOSUB1540:GOTO 1220
1230 FORT=1 TO 2:Z=Z+&H140:GOSUB
1540:NEXTT
1240 FORT=1 TO 3:Z=Z+&HA0:GOSUB1
540:NEXTT
1250 FORT=1 TO 5:Z=Z+&H20:GOSUB1
540:NEXTT
1260 IF E=F AND E=G AND E<>8 THE
N PLAY"O3CEFGGABO4CDEFGABO5CDEFG
ABO3CDEFGABO4CDEFGABO5CDEFGABO1C
DEFGABO2CDEFGABO3CDEFGABO4CDEFGA
BO5CDEFGAB" ELSE GOTO 1350
1270 IF E=1 THEN S=S+I*5
1280 IF E=2 THEN S=S+I*20
1290 IF E=3 THEN S=S+I*100
1300 IF E=4 THEN S=S+I*60
1310 IF E=5 THEN S=S+I*10
1320 IF E=6 THEN S=S+I*40
1330 IF E=7 THEN S=S+I*2
1340 GOTO 1510
1350 IF E=8 AND F=8 AND G=8 THEN
 PLAY"O5BAGFEDCO4BAGFEDCO3BAGFED
CO2BAGFEDCO1BAGFEDC":S=S/2:GOTO
1510
1360 IF E=8 OR F=8 OR G=8 THEN 1
500
1370 S$="O3CDEFGABCDEFGABCDEFGAB
":IF E=F AND E<>7 AND E<>5 AND E
<>1 THEN PLAY S$ ELSE 1430
1380 IF E=3 THEN S=S+I*10
1390 IF E=4 THEN S=S+I*5
1400 IF E=6 THEN S=S+I*2
1410 IF E=2 THEN S=S+I
1420 GOTO 1510
1430 IF E=G AND E<>7 AND E<>5 AN
D E<>1 THEN PLAY S$:GOTO 1380
1440 IF F=G AND F<>7 AND F<>5 AN
D F<>1 THEN PLAY S$ ELSE 1500
1450 IF F=3 THEN S=S+I*10
1460 IF F=4 THEN S=S+I*5
1470 IF F=6 THEN S=S+I*2
1480 IF F=2 THEN S=S+I
1490 GOTO 1510
1500 PLAY"O2BAGFEDCO1BAGFEDC"
1510 GOSUB1520:GOTO 850
1520 S=INT(S):IF S<2 THEN S=2
1530 HCOLOR15:HLINE(160,176)-(31
9,184),PSET,BF:HCOLOR0:HPRINT(21
,22),STR$(S):RETURN
1540 IF X>&H37FF THEN X=X-&H2800
1550 IF Y>&H37FF THEN Y=Y-&H2800
1560 IF Z>&H37FF THEN Z=Z-&H2800
1570 A$=HEX$(X):B$=HEX$(Y):C$=HE
X$(Z):D1=VAL("&H"+LEFT$(A$,2)):D
2=VAL("&H"+RIGHT$(A$,2)):D3=VAL(
"&H"+LEFT$(B$,2)):D4=VAL("&H"+RI
GHT$(B$,2)):D5=VAL("&H"+LEFT$(C$
,2)):D6=VAL("&H"+RIGHT$(C$,2))
1580 POKE&HF06,D1:POKE&HF07,D2:P
OKE&HF0F,D3:POKE&HF10,D4:POKE&HF
18,D5:POKE&HF19,D6
1590 EXEC&HF00:RETURN
```

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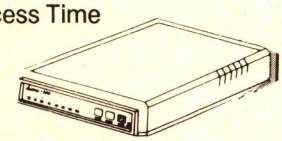

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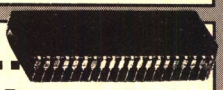

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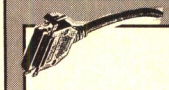

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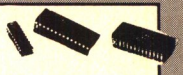

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UPS 2ND DAY AIR

Integers in Order

by Steve Blyn
Contributing Editor

Tailored to meet the needs of intermediate school students, this month's article concerns finding consecutive numbers that add up to a particular sum. This type of problem is one of the many verbal problems students learn to solve in beginning algebra classes.

Over the years, I have used computer programs to present verbal problems, because I think they often prove difficult for students without both strong verbal and arithmetic skills. Computer programs provide a pleasant way to practice these particular problems.

A consecutive integer problem is concerned with an integer, which is defined as any whole number, positive or negative. Zero is considered an integer. Examples of integers are -5, 0 and 128. An even integer is an integer that is twice the amount of another integer. For example, -10 and 246 are even integers. An odd integer is not even; for example, 13 and 201 are odd integers.

Consecutive integers are integers that differ by a value of one. If the first of three consecutive numbers is represented by the variable *n*, then the next two integers may be represented by *n+1* and *n+2*. This formula is used in program Line 50.

Both odd and even consecutive integers differ by a value of two. To ensure an even integer, you can double any random number. This is used in program Line 60 (`N=RND(15)*2`). To ensure an odd integer, you first obtain an even integer, then subtract one. This is used in Line 70 (`N=RND(15)*2-1`). Succeeding odd or even integers will then be the previous integer increased by two.

Let's solve a typical example together.

Problem: Find three consecutive even integers with the sum of 60.

Let $2n$ = first integer
Let $2n+2$ = second integer
Let $2n+4$ = third integer

Formula: $2n+2n+2+2n+4=60$
Combine like terms: $6n+6=60$
Solve for n: $6n=54$
Solution: $n=9$

Check:
The first integer is $2n$, which equals 18
The second integer is 18+2=20
The third integer is 20+2=22
The total of the three is 60.

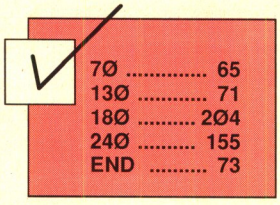
Summary

The program generates random examples, and the student is required to solve only for the first integer of the answer in each example. The other two integers and the sum are worked out on the computer screen for the student. This enables the student to see the checkup as well as the example.

Each set has ten practice problems. The program displays a score so the student can check his progress. After each set, the student may end the program or begin again. Please feel free to make modifications to the program. Altering the random numbers used on lines 50 through 70 changes the difficulty level of the program. ❑

Steve Blyn teaches both exceptional and gifted children, holds two master's degrees, and has won awards for the design of programs to aid the handicapped. He owns Computer Island and lives in Staten Island, New York.

16K Extended



The Listing: CONSEC

```
10 REM"CONSECUTIVE NUMBER PROBLE
MS"
20 REM"STEVE BLYN,COMPUTER ISLAN
D,STATEN ISLAND,NY,1990"
30 X=RND(-TIMER):CLS:PLAY"O3L20G
EC":CT=CT+1
40 R=RND(3):Z=Z+1:IF CT=11 THEN
250
50 IF R=1 THEN N=RND(20)+10:C=N+
N+1+N+2
60 IF R=2 THEN N=RND(15)*2:C=N+N
+2+N+4
70 IF R=3 THEN N=RND(15)*2-1:C=N
+N+2+N+4
80 IF R=1 THEN B$="CONSECUTIVE"
ELSE IF R=2 THEN B$="CONSECUTIVE
 EVEN" ELSE B$="CONSECUTIVE ODD"
90 PRINT@2,"CONSECUTIVE NUMBER P
ROBLEMS";
100 PRINT@32,STRING$(32,224);
110 PRINT@64,"#";Z;"FIND THREE "
;B$
120 PRINT@96,"NUMBERS WHOSE SUM
IS ";C
130 PRINT@160,"THE FIRST NUMBER
IS ";:INPUT A1
140 IF A1=N THEN PLAY"O4L50CDEFG
GG":SC=SC+1:PRINT@200,"CORRECT";
150 IF A1<>N THEN SOUND6,3:SOUND
 10,3:PRINT@200,"SORRY,  IT'S ";
N;
160 PRINT@227,"let's check now";
:GOSUB 240
170 PRINT@256,"THE SECOND NUMBER
 IS ";:IF R=1 THEN A2=N+1 ELSE A
2=N+2
180 PRINTA2;:GOSUB 240:PRINT@320
,"THE THIRD NUMBER IS  ";:IF R=1
 THEN A3=N+2 ELSE A3=N+4
190 PRINTA3;:GOSUB 240:PRINT@373
,"--";
200 PRINT@394,"THE TOTAL =";C
210 PRINT@416,STRING$(32,224);:P
RINT@452,"PRESS ENTER TO CONTINU
E";
220 EN$=INKEY$
230 IF EN$=CHR$(13) THEN 30 ELSE
 220
240 FOR T=1 TO 1000:NEXT T:PLAY"
O3L20GC":RETURN
250 CLS:PRINT@6,"YOUR SCORE WAS"
;SC*10;"%"
260 PRINT@96,"PRESS e TO END OR
a FOR ANOTHER";
270 EN$=INKEY$
280 IF EN$="E" THEN END ELSE IF
EN$="A" THEN RUN ELSE 270
```

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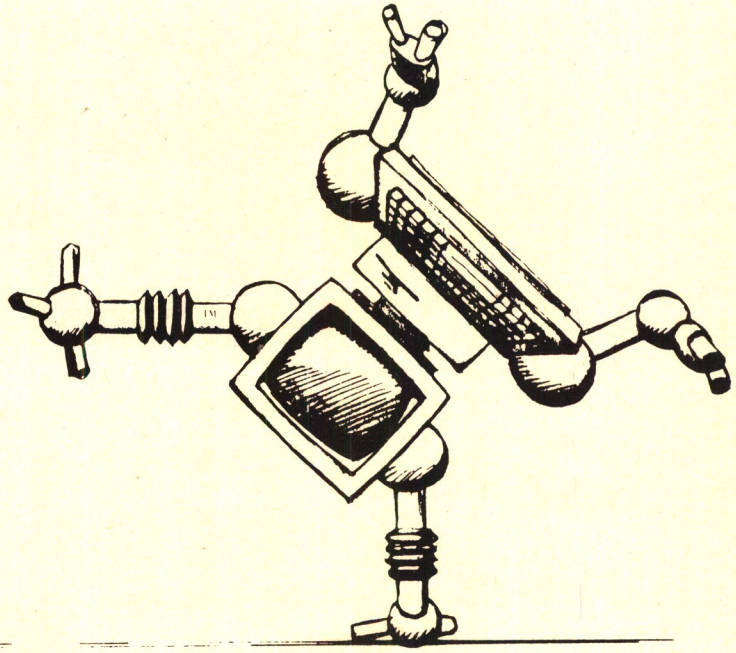

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COLORWARE

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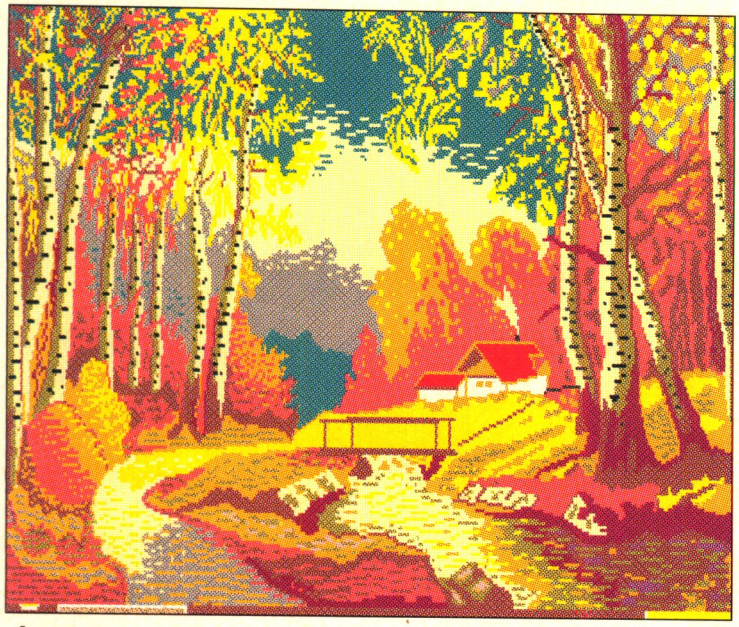
Don't send us anything owned by someone else; this means no game screens, digitized images from TV programs or material that's already been submitted elsewhere. A digitized copy of a picture that appears in a book or magazine is not an original work.

We will award one first prize of $25, one second prize of $15 and one third prize of $10.

Please send your entry on either tape or disk to the CoCo Gallery, THE RAINBOW, P.O. Box 385, Prospect, KY 40059. Remember, this is a contest and your entry will not be returned.

—Tony Olive, Curator

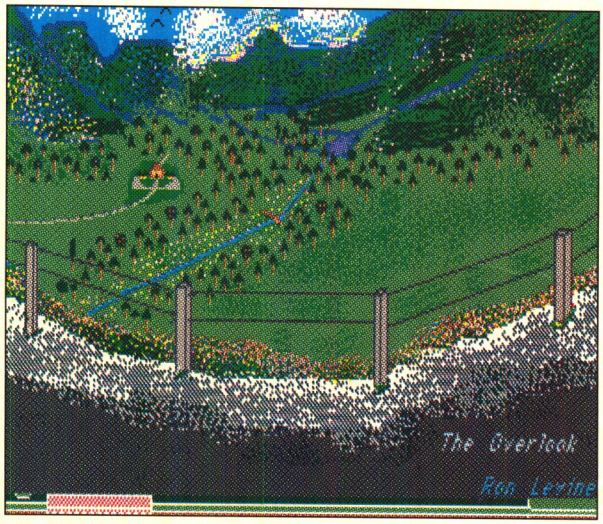
1st Place



Autumn
Waddy Juraszek

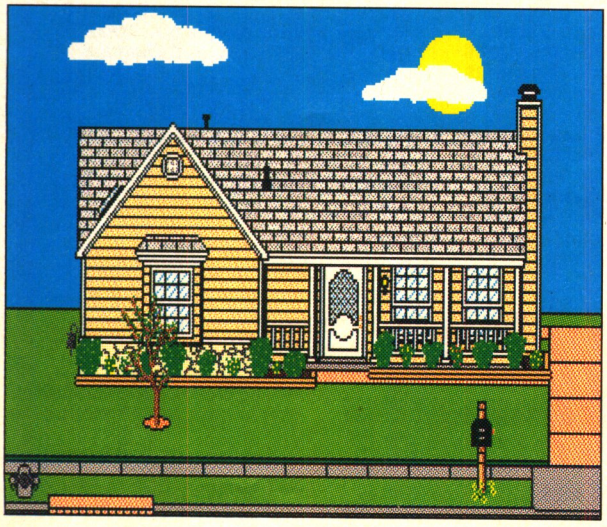
Waddy is a scenery maker at the Australian Opera Company, and ever since buying *CoCo Max III* he has wanted to enter this competition. This countryside cottage scene was drawn on plain paper, then graph paper, and finally onto the screen. Waddy lives in Liverpool, New South Wales.

2nd Place



The Overlook
Ron Levine

Ron is a communications technician in the Atlanta area and has been a devoted CoCo user since the first grey CoCo. His hobbies include playing the guitar, cooking and Adventure games. He is married and has three children who are all CoConuts. Ron lives in Kennesaw, Georgia. The picture was designed using *CoCo Max III*.



3rd Place

Our House
Logan Ward

Logan, who resides in Memphis, Tennessee, created this view of his house using *Color Max 3*. You may be familiar with the Maxwell Mouse cartoons Logan has contributed to issues of the RAINBOW.

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-Fully assembled and tested board
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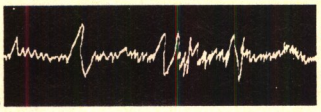
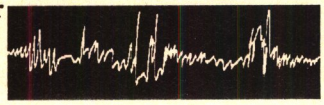
-Complete with 512k software
-RamDisk, RamTest, & Print Spooler

512k board w/software ... $89.95
0k board w/software ... $34.95



Studio Works

Digital Audio Sampler



Studio Works Pro

NEW! CD Quality samples up to 35k by 8 bits! Supports 1 MEG systems! Optional MIDI, MIC, and DC inputs!
Disk Only - $38.95 With Cable - $53.95
With CD Quality ADC 8 bit Rom Pak - $94.95

Soundtrax

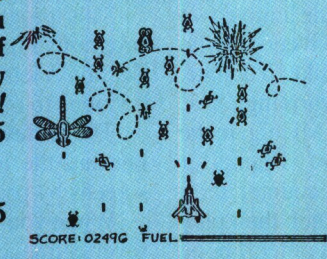
The perfect partner for Studio Works! Soundtrax is a sound sequencing system that imports digitized audio samples & provides total control.
For CoCo 3, mouse/joystk, & disk $34.95

Zenix

NEW

An extremely *fast* and *exciting* arcade style game with 32 levels of play! You must *Blast* your way through a race of spacefaring insectoids and ultimately reach & destroy their planet, *ZENIX!*
For CoCo 3, joystk & disk ... $29.95

Games



Zenix

Those Darn Marbles

This *NEW* 512k only, arcade style, 3D marble game features extra smooth, hardware screen scrolling, great sound effects, and almost 1 meg of graphics to produce *incredible* CoCo 3 action!
512k CoCo 3, joystk, & disk .. $31.95

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Sinistaar 512k

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Warrior King

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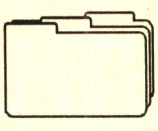
Paladin's Legacy

CoCo 1,2,3, joystk, & disk ... $24.95

CoCo 3 $29.95 NEW **Suprfile III** NEW MS/Dos $39.95

Suprfile III is a powerful, user friendly, easy to use, multi-purpose database! It can be used for Mailing lists, Labels, a Checkbook Manager, Shopping lists, Personal items inventory, Audio/Video lists and on and on!
Features: Add, Delete, Search, Sort, Print Labels & Reports.



Fkeys III (CoCo 1,2, 3) $19.95
Sixdrive (CoCo 1,2, 3) $16.95

Locking Plates (CoCo 2 or 3) $7.95
Multi-Label III (CoCo 3 only) $16.95

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Learning Letter Sequence

by Fred B. Scerbo
Contributing Editor

If you have an idea for the "Wishing Well," submit it to Fred c/o THE RAINBOW. *Remember, keep your ideas specific, and don't forget this is* BASIC. *All programs resulting from your wishes are for your use, but remain the property of the author.*

Receiving reader mail is one of the most satisfying things about writing this column. In recent years, many readers have donated CoCos and disk drives to our special needs classes. That request was made almost two years ago and I still get calls or letters from people who say they have an old CoCo and a disk drive they'd like to donate. The generosity of CoCo users is sometimes heartwarming.

I received a letter from Jana Wallace of Jackson, Michigan, the last paragraph of which I will share with you. It reads: "Thanks for your interest in children! I bought my CoCo to counter their interest in Nintendo. They always seem to fight when they play Nintendo, but when at the computer they help each other. I hope to get them interested in their own programming."

That's the whole purpose of "The Wishing Well." With our CoCo and the right software you can make your family's time in front of the tube educational.

Recently I received a request for a program to drill students in naming the correct letter between two others, such as: What comes between E and G? These are important skills, however, this is not a practical way to quiz a student who needs to learn these skills. Obviously you cannot expect a student who lacks the ability to put letters in alphabetical order to be able to read a sentence that asks that question.

A logical way to present this material is to use the structure that most of our recent programs use: the opposites grids used the *Music* series. This is also the structure used in the program *Letters*.

Unfortunately, the graphics used for *Letters* are a little too large for this purpose. By rewriting and changing the S value in the draw statements from S4 to S3, I came up with some totally new graphics data lines using an onscreen editor to merge data lines. The program is changed in spots, but still works the same way. In other words, it instructs in the Review mode rather than just quizzing students. This is the true characteristic of educational software — it instructs.

Using the Program

This program runs easily, like the other recent educational programs I have listed. When you run BETWEEN, you see a menu. Section A lets you review, and B and C give you two different quiz versions to try.

The review section works by showing each letter of the alphabet and the letters that surround it. You advance through the screens by pressing ENTER.

When you use the quiz section, the upper-right corner shows a reverse-image choice, such as a letter of the alphabet. The next three boxes show the possible letters to surround it. Pressing the space bar moves you through the choices. Pressing ENTER records your answer. If you are correct, the correct answer appears. If you are incorrect, you can try again until you get it right.

Pressing @ lets you check your score, and pressing C to continue lets you pick up where you left off.

As I mentioned earlier, this method allows you to use the program with youngsters not yet able to read. Even the youngest CoCo user can manipulate the space bar and ENTER key. Thus we have an excellent tool for introducing the very young to the world of computers.

The Future

Notice this program is titled *In-Between* Volume 1. A follow-up program is logical. There is a real need for teaching these skills, and these programs are capable of performing the task well.

Please keep your comments and suggestions coming in. It really helps to know what your needs are so I can work to help fill them.

❑

Fred Scerbo is a special needs instructor for the North Adams Public Schools in North Adams, Massachusetts. He holds a master's in education and has published some of the first software available for the Color Computer through his software firm, Illustrated Memory Banks.

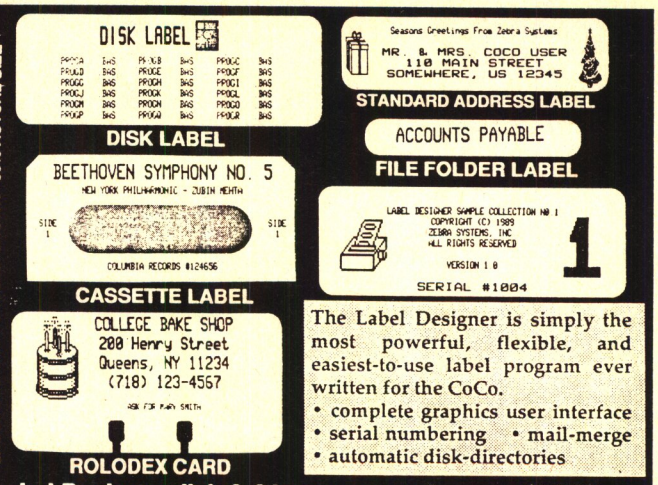
32K Extended

```
20 ..... 60
35 ..... 149
55 ..... 252
75 ..... 130
100 ..... 100
130 ..... 110
155 ..... 96
195 ..... 158
240 ..... 214
280 ..... 127
310 ..... 109
340 ..... 65
365 ..... 219
383 ..... 83
400 ..... 37
420 ..... 188
440 ..... 33
460 ..... 178
480 ..... 173
500 ..... 165
520 ..... 121
540 ..... 186
555 ..... 223
575 ..... 119
595 ..... 73
615 ..... 8
630 ..... 251
655 ..... 25
END ..... 177
```

The Listing: BETWEEN

```
1 REM**************************
2 REM*     IN-BETWEEN VOL.1     *
3 REM*   COPYRIGHT (C) 1990     *
4 REM*     BY FRED B. SCERBO    *
5 REM*     60 HARDING AVENUE    *
6 REM*  NORTH ADAMS, MA 01247   *
7 REM**************************
10 CLEAR3000
15 CLS0:PRINTSTRING$(32,220);STR
```


LABEL DESIGNER LABELS SHOWN -35% ACTUAL SIZE



The Label Designer is simply the most powerful, flexible, and easiest-to-use label program ever written for the CoCo.
- complete graphics user interface
- serial numbering
- mail-merge
- automatic disk-directories

Label Designer disk & 64 page manual $29.95
Assortment of different size and color labels.....$5.00

"I made a number of signs, cards and banners with CoCo Graphics Designer Plus and was thrilled with them all."
--Jim Issel
May 89 Rainbow

The CoCo Graphics Designer Plus, produces beautiful greeting cards, banners, and signs .

The CGDP features an easy-to-use point and click graphical interface with windows, scroll bars, radio buttons, and joystick or mouse control. Text can be used in up to 4 sizes and 16 fonts per page. Picture, Font, and Border collections are included. Signs and cards can be previewed on screen. ... Rave review in May 89 Rainbow (pages 110 - 113).

CGDP Disk & 64 page manual.....$29.95

OPTIONAL PICTURE, FONT, AND BORDER DISKS: $14.95 EACH.

Picture Disk #2 4 sets of 30 pictures ea., Sports, America, Party, Office, Total 120 pictures.
Picture Disk #3 4 sets of 30 pictures ea. Animals, Nature, Religion, Travel, Total 120 pictures.
Picture Disk #4 120 Holiday Pictures: Christmas, Chanukah, Thanksgiving, New Year's, Easter, Halloween, etc.
Font Disk A 10 Fonts: Western, Stencil, Banner, Shadow, Variety, Type, Stripes, Digital, Bold3, Object
Font Disk B 10 Fonts: Arcade, Circle, Alien, Cube, Baroque, Deco, Block, Gray, Computer, Script
Border Disk #1 Contains 176 High resolution borders, great variety from simple to ornate. (The border disk is for use with the CGDP, but not with the Label Designer).

Above programs require a CoCo II 64K or CoCo III, disk drive, RSDOS, joystick or mouse. Printers supported include: Epson RX/FX/LX, Gemini 10X, SG10, NX10, NX1000, DMP105/106/110/120/130/132/133/200/400, Panasonic KXP1080 / 90 /91/92, Prowriter, C.Itoh 8510, Okidata 92/93/182/183 & more.

Ordering Instructions: All orders add $3.00 Shipping & Handling, UPS COD $3.50 additional. VISA/MC Accepted. PA residents add sales tax. Hours 9-5:45 M-F .

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State College, PA 16801
(814) 237-2652

```
ING$(32,204);:FORI=1TO160:READA:
PRINTCHR$(A+128);:NEXT
20 PRINTSTRING$(32,195);STRING$(
32,211);
25 DATA93,88,93,80,93,88,16,45,4
4,44,34,45,44,45,37,44,45,44,45,
37,40,,45,36,46,45,36,46,45,37,3
2,37
30 DATA85,,85,89,85,,,37,,,42,37
,,33,36,,37,,36,37,,,37,,42,33,,
42,33,37,41,37
35 DATA85,,85,80,93,,28,37,44,44
,34,37,44,45,,,37,,,37,,34,37,,4
6,45,,46,45,37,32,45
40 DATA85,,85,,85,,,37,,,42,37,,
32,,,37,,,37,,42,37,,42,32,,42,,
37,,37
45 DATA87,82,87,82,87,82,,39,35,
34,40,39,35,39,,,39,34,,37,35,43
,39,33,43,39,33,43,39,37,,37
50 PRINT@358," AN INTRODUCTION T
O  ";:PRINT@390," SEQUENCE IN LE
TTERS ";
55 PRINT@422,"  BY FRED B.SCERBO
   ";:PRINT@454," COPYRIGHT (C)
1990  ";
60 X$=INKEY$:IFX$<>CHR$(13)THEN6
0
65 DIM P$(26,3),A$(6),B$(26),C$(
26),A(26),N(26),B(4),C(4),D(4),E
(4),F(4),AO(26)
70 FORI=1TO3:READ C(I),D(I),E(I)
,F(I):NEXT:FORI=1TO6:READA$(I):N
EXT:FORI=1TO26:READP$(I,1),P$(I,
2):NEXT
75 COLOR1,0
80 CLS:PRINT:PRINTSTRING$(32,"=")
;:PRINT@102,"AN INTRODUCTION TO
":PRINT@134,"SEQUENCE IN LETTERS
":PRINT@199,"A) REVIEW LETTERS":
PRINT@263,"B) QUIZ SPACES":PRINT
@327,"C) QUIZ LETTERS"
85 PRINT@388,"<<<SELECT YOUR CHO
ICE>>>"
90 PRINT:PRINTSTRING$(32,"=");
95 X$=INKEY$:X=RND(-TIMER):IFX$=
"A"THEN350ELSEIFX$="B"THEN100ELS
EIFX$="C"THEN640ELSE95
100 CLS0:PMODE0,1:PCLS1
105 LINE(0,0)-(254,170),PRESET,B
110 LINE(6,4)-(122,82),PRESET,BF
115 LINE(128,4)-(248,82),PRESET,
B
120 LINE(6,86)-(122,164),PRESET,
B
125 LINE(128,86)-(248,164),PRESE
T,B
130 DRAW"BM26,188C0NU10R10NU10BR
6R10U6L10U4R10BR6NR10D4NR10D6R10
BR12BU6NE4D2F4BR6R10U6L10U4R10BR
6ND10R10D4NL10BR6NR10D6U10R10D10
BR6NR10U10R10BR6NR10D4NR10D6R10B
R10U10NL4R10D4NL10D6NL14BR6U10R1
0D4NL10D6BR6U10R10D4L10R4F6BR6E4
U2H4"
135 DATA130,6,246,80,6,86,120,16
2,130,86,246,162
140 PAINT(2,2),0,0:PCOPY1TO3
145 PMODE0,4:PCLS1
150 LINE(0,0)-(254,170),PRESET,B
F
155 LINE(8,6)-(120,80),PSET,BF
160 PCOPY4TO2:PMODE0,1:SCREEN1,1
165 DATA"S3BM2,8C1","S3BM130,8C0
","S3BM2,90C0","S3BM130,90C0","S
3BM2,48C0","S3BM130,48C0"
170 FORI=1TO26
175 A(I)=RND(26):IFN(A(I))=1THEN
175
180 N(A(I))=1:NEXTI:FORY=1TO26:C
OLOR1,0
185 FORI=2TO4
190 B(I)=RND(3)+1:IFN(B(I))=0THE
N190
195 N(B(I))=0:NEXTI:FORI=1TO4:N(
I)=1:NEXT
200 B=RND(26):IFB=A((Y))THEN200
205 C=RND(26):IFC=B OR C=A((Y))T
HEN205
210 DRAW A$(1):DRAWP$(A(Y),1)
215 DRAW A$(B(2)):DRAWP$(B,2):DR
AWP$(B,3)
220 DRAW A$(B(3)):DRAWP$(C,2):DR
AWP$(C,3)
225 DRAW A$(B(4)):DRAWP$(A(Y),2)
:DRAWP$(A(Y),3)
230 COLOR1,0
235 Z=0
240 PMODE0,4
245 DRAW A$(1)+"C0":DRAWP$(A(Y),
1)
250 DRAW A$(B(2))+"C1":DRAWP$(B,
2):DRAWP$(B,3)
255 DRAW A$(B(3))+"C1":DRAWP$(C,
2):DRAWP$(C,3)
260 DRAW A$(B(4))+"C1":DRAWP$(A(
Y),2):DRAWP$(A(Y),3)
265 PMODE0,1:SCREEN1,1
270 LINE(8,6)-(120,80),PSET,B
275 X$=INKEY$:IFX$=" "THEN285ELS
EIFX$="@"THEN650
280 COLOR1,0:LINE(8,6)-(120,80),
PRESET,B:GOTO270
285 Z=Z+1:IFZ=4THENZ=1
290 COLOR1,0:LINE(C(Z),D(Z))-(E(
Z),F(Z)),PSET,B
295 X$=INKEY$:IFX$=" "THEN285ELS
EIFX$=CHR$(13)THEN305ELSEIFX$="@
"THEN650
300 COLOR1,0:LINE(C(Z),D(Z))-(E(
Z),F(Z)),PRESET,B:GOTO290
305 IFZ+1=B(4)THEN315
310 NW=NW+1:FORK=1TO5:PMODE0,4:S
CREEN1,1:SOUND10,3:PMODE0,1:SCRE
EN1,1:SOUND1,3:NEXTK:GOTO290
315 NC=NC+1:PMODE0,4:PCLS1:LINE(
0,40)-(256,126),PRESET,B:LINE(6,
44)-(124,122),PRESET,B:LINE(130,
44)-(248,122),PRESET,B:PAINT(2,4
2),0,0
320 DRAW A$(5):DRAWP$(A(Y),1)
325 DRAW A$(6):DRAWP$(A(Y),2):DR
AWP$(A(Y),3)
330 SCREEN1,1
335 X$=INKEY$:IFX$<>CHR$(13)THEN
335
340 PMODE0,1
345 PCOPY3TO1:SCREEN1,1:PCOPY2TO
4:NEXTY:GOTO650
350 PMODE0,2:PCLS1:SCREEN1,1:LIN
E(0,40)-(256,126),PRESET,B:LINE(
6,44)-(124,122),PRESET,B:LINE(13
0,44)-(248,122),PRESET,B:PAINT(2
,42),0,0
355 FORI=1TO26:DRAW A$(5):DRAWP$
(I,1)
360 DRAW A$(6):DRAWP$(I,2):DRAWP
$(I,3)
365 X$=INKEY$:IFX$<>CHR$(13)THEN
365
370 COLOR1,0:LINE(8,46)-(122,120
),PSET,BF:LINE(132,46)-(246,120)
,PSET,BF:NEXTI
375 RUN
380 DATA"BD64BR54M+20,-40R8M+20,
+40L10M-8,-16L12M-8,+16NL10BM+11
,-22UM+3,-6RM+3,+6DL6
385 DATA"BD64BR34R2BR8R2BR8R2BR8
R2BR8U6R4U28L4U6R34F4D12G4F4D12G
4NL34BH6NL16E2U6H4L14ND10BU8R14E
4U4H2L16D10"
390 DATA"BD64BR56U6R4U28L4U6R34F
4D12G4F4D12G4NL34BH6NL16E2U6H4L1
4ND10BU8R14E4U4H2L16D10"
395 DATA"BD64BR16M+20,-40R8M+20,
+40L10M-8,-16L12M-8,+16NL10BM+11
,-22UM+3,-6RM+3,+6DL6BD22BR34R2B
R8R2BR8R2BR8R2BR8H4U30E6R28F6D6L
8H4L14G4D18F4R14E4R8D6G6L28"
400 DATA"BD64BR60H4U30E6R28F6D6L
8H4L14G4D18F4R14E4R8D6G6L28"
405 DATA"BD64BR20U6R4U28L4U6R34F
4D12G4F4D12G4NL34BH6NL16E2U6H4L1
4ND10BU8R14E4U4H2L16D10BD24BR34R
2BR8R4BR8R2BR8R4BU2U6R4U28L4U6R3
4F4D32G4NL34BH6NL16E2U24H2L16D26
"
410 DATA"BD64BR58U6R4U28L4U6R34F
4D32G4NL34BH6NL16E2U24H2L16D26"
415 DATA"BD64BR20H4U30E6R28F6D6L
8H4L14G4D18F4R14E4R8D6G6NL28BR8R
2BR8R4BR8R2BR8R4BR8U40R40D8L30D8
R20D8L20D8R30D8L40"
420 DATA"BD64BR58U40R40D8L30D8R2
0D8L20D8R30D8L40"
425 DATA"BD64BR20U6R4U28L4U6R34F
4D32G4NL34BH6NL16E2U24H2L16D26BD
6BR30R4BR8R2BR8R4BR8R2BR8U40R40D
8L30D8R20D8L20D16L10"
430 DATA"BD64BR58U40R40D8L30D8R2
0D8L20D16L10"
435 DATA"BD64BR18U40R40D8L30D8R2
0D8L20D8R30D8NL40BR8R2BR8R4BR8R2
BR8R4BR8H6U28E6R28F6D6L8H4L14G4D
16F4R14E4U2L10U8R18D16G6L28"
440 DATA"BD64BR62H6U28E6R28F6D6L
8H4L14G4D16F4R14E4U2L10U8R18D16G
6L28"
445 DATA"BD64BR28U40R40D8L30D8R2
0D8L20D16NL10BR20R2BR8R2BR8R4BR8
R2BR8U40R8D16R20U16R8D40L8U16L20
D16L8"
450 DATA"BD64BR60U40R8D16R20U16R
8D40L8U16L20D16L8"
455 DATA"BD64BR30H6U28E6R28F6D6L
8H4L14G4D16F4R14E4U2L10U8R18D16G
6NL28BR8R2BR8R4BR8R2BR8R4BR8U6R6
U28L6U6R20D6L6D28R6D6L20"
460 DATA"BD64BR70U6R6U28L6U6R20D
6L6D28R6D6L20"
465 DATA"BD64BR20U40R8D16R20U16R
8D40L8U16L20D16L8BR46R2BR8R4BR8R
2BR8H4U12R8D4F4R8E4U22L12U6R34D6
L12D28G6L22"
470 DATA"BD64BR60H4U12R8D4F4R8E4
U22L12U6R34D6L12D28G6L22"
475 DATA"BD64BR30U6R6U28L6U6R20D
6L6D28R6D6NL20BR8R2BR8R4BR8R2BR8
U40R10D16E16R12G20F20L12H16D16L1
0"
480 DATA"BD66BR58U40R10D16E16R14
G20F14R2F6L12H16D16L10"
485 DATA"BD64BR26H4U12R8D4F4R8E4
U22L12U6R34D6L12D28G6NL22BR14R2B
R8R4BR8R2BR8R4BR8U40R10D32R22D8L
30"
490 DATA"BD64BR62U40R10D32R22D8L
30"
495 DATA"BD66BR16U40R10D16E16R14
G20F14R2F6L12H16D16L10BR48R2BR8R
4BR8R2BR8U40R10F14E14R10D40L10U2
```

```
8G14H14D28L10"
500 DATA"BD64BR58U40R10F14E14R10
D40L10U28G14H14D28L10"
505 DATA"BD64BR16U40R10D32R22D8N
L30BR8R2BR8R4BR8R2BR10U40R16M+20
,+30U30R10D40L16M-20,-30D30L10"
510 DATA"BD64BR58U40R16M+20,+30U
30R10D40L16M-20,-30D30L10"
515 DATA"BD64BR20U40R10F14E14R10
D40L10U28G14H14D28L10BR54R2BR8R4
BR8R2BR8H4U30E6R30F6D6ND16BL10H4
L14G4D16F4R14E4NU14BR10D8G6L30"
520 DATA "BD60BR62NF4U30E6R30F6D
6ND16BL10H4L14G4D16F4R14E4NU14BR
10D8G6L30"
525 DATA"BD64BR16U40R16M+20,+30U
30R10D40L16M-20,-30D30L10BR50BR8
R2BR8R4BR8R2BR12U40R30F4D16G4L20
D16NL10BU24U8R12F2D6G2L12"
530 DATA"BD64BR68U40R30F4D16G4L2
0D16NL10BU24U8R12F2D6G2L12"
535 DATA "BD60BR18NF4U30E6R30F6D
6ND16BL10H4L14G4D16F4R14E4NU14BR
10D8G6NL30BR14R2BR8R4BR8R2BR14BU
2H6U28E6R30F6D6ND14BL10H4L14G4D1
6F4R8H6R6F6E4NU14BR10D6G8F6L6H6L
22"
540 DATA"BD64BR66H6U28E6R30F6D6N
D14BL10H4L14G4D16F4R8H6R6F6E4NU1
4BR10D6G8F6L6H6L22"
545 DATA"BD64BR18U40R30F4D16G4L2
0D16NL10BU24U8R12F2D6G2NL12BD26B
R8R2BR8R4BR8R2BR8R4BR14U40R30F4D
16G4BL20D16NL10BU24U8R12F2D6G2L1
2BD8F16R12H16R6"
550 DATA"BD64BR60U40R30F4D16G4BL
20D16NL10BU24U8R12F2D6G2L12BD8F1
6R12H16R6"
555 DATA"BD64BR20H6U28E6R30F6D6N
D14BL10H4L14G4D16F4R8H6R6F6E4NU1
4BR10D6G8F6L6H6NL22BR22R2BR8R4BR
8R2BR8U8R30U8L30U24R38D8L28D8R28
D24L38"
560 DATA"BD64BR60U8R30U8L30U24R3
8D8L28D8R28D24L38"
565 DATA"BD64BR20U40R30F4D16G4BL
20D16NL10BU24U8R12F2D6G2L12BD8F1
6R12H16NR6F16BR8R2BR8R4BR8R2BR8U
6R6U26L18U8R44D8L18D26R6D6L20"
570 DATA"BD64BR68U6R6U26L18U8R44
D8L18D26R6D6L20"
575 DATA"BD64BR20U8R30U8L30U24R3
8D8L28D8R28D24NL38BR8R2BR8R4BR8R
2BR8U40R10D32R20U32R10D40L38"
580 DATA"BD64BR58U40R10D32R20U32
R10D40NL38"
585 DATA"BD64BR28U6R6U26L18U8R44
D8L18D26R6D6NL20BR18R2BR8R4BR8R2
BR14M-20,-40R12M+16,+32M+16,-32R
12M-20,+40L14"
590 DATA"BD64BR72M-20,-40R12M+16
,+32M+16,-32R12M-20,+40L14"
595 DATA"BD64BR18U40R10D32R20U32
R10D40NL38BR10R2BR8R4BR8R2BR8M-1
0,-40R10M+8,+32M+8,-32R16M+8,+32
M+8,-32R10M-10,+40L16M-8,-32M-8,
+32L16"
600 DATA"BD64BR58M-10,-40R10M+8,
+32M+8,-32R16M+8,+32M+8,-32R10M-
10,+40L16M-8,-32M-8,+32L16"
605 DATA"BD64BR28M-20,-40R12M+16
,+32M+16,-32R12M-20,+40NL14BR8R2
BR8R4BR8R2BR10E20H20R12F16E16R12
G20F20L12H16G16L12"
610 DATA"BD64BR56E20H20R12F16E16
R12G20F20L12H16G16L12"
615 DATA"BD64BR28M-10,-40R10M+8,
+32M+8,-32R16M+8,+32M+8,-32R10M-
10,+40L16M-8,-32M-8,+32NL16BR38R
2BR8R4BR8R2BR8U16M-14,-24R12M+8,
+14M+8,-14R12M-14,+24D16L12"
620 DATA"BD64BR72U16M-14,-24R12M
+8,+14M+8,-14R12M-14,+24D16L12"
625 DATA"BD64BR16E20H20R12F16E16
R12G20F20L12H16G16NL12BR46R2BR8R
4BR8R2BR8U8E24L24U8R36D8G24R24D8
L36"
630 DATA"BD64BR60U8E24L24U8R36D8
G24R24D8L36"
635 DATA"BD64BR30U16M-14,-24R12M
+8,+14M+8,-14R12M-14,+24D16NL12B
R20R2BR8R4BR8R2BR8R4BR8R2BR8"
640 CLS0:FORI=1TO26:TEM$=P$(I,1)
:P$(I,1)=P$(I,2):P$(I,2)=TEM$:NE
XT
645 GOTO100
650 CLS:PRINT@101,"YOU TRIED"NC+
NW"TIMES &":PRINT@165,"ANSWERED"
NC"CORRECTLY"
655 PRINT@229,"WHILE DOING"NW"WR
ONG."
660 NQ=NC+NW:IF NQ=0THEN NQ=1
665 MS=INT(NC/NQ*100)
670 PRINT@293,"YOUR SCORE IS"MS"
%."
675 PRINT@357,"ANOTHER TRY (Y/N/
C) ?";
680 X$=INKEY$:IFX$="Y"THEN RUN
685 IFX$="N"THENCLS:END
690 IFX$="C"THEN265
695 GOTO680
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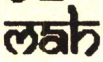

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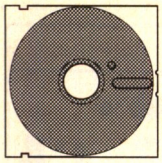
If you killed it, you can resurrect it

Back From the Dead

by Bill Daniels



ops! You've just killed a needed file on your working disk and backup disk. (Of course you had a backup disk. Anything else is hard to imagine.) You now have a sinking feeling in your stomach, a feeling experienced by all of us at one time or another. However, with *Disk Editor*, this article and some work, there is hope.

It is possible to restore a killed file if a new file has not been saved to the disk on top of the one you killed. When you kill a disk file, its contents are not erased, but you do erase the first character in the filename and one or more entries in the *file allocation table* (FAT). Restore this data and your killed file rises from the ashes.

There is a catch to this. Until you restore the necessary data, the computer doesn't know your file exists. If you save a new file, it may be written on top of the disk space occupied by the killed file, and the game's over before you even start.

The First Step

If you think you may still be in the game, the first thing to do is backup your disk using the BACKUP command, which copies the disk in its current state. Be aware that the following procedures are a bit tricky and you can easily scramble your disk if you make an error.

One way to speed up the restoration process is to backup the disk to a suitable RAM disk. Disk scanning, editing and testing is done faster in memory. After you are satisfied the RAM disk is right, copy it back to a physical disk.

Bill Daniels has been programming the CoCo since 1981. He and his wife, Gladys, operate an accounting service using CoCo's exclusively. You can contact him at P.O. Box 124, Station A, Mississauga, Ontario Canada L5A 2Z7.

Finding and Editing Data

Next you must attain the ability to scan the disk's directory and change the necessary fields. Some commercial utility programs scan the disk and change it one byte at a time. If you have such a program, you're in good shape; otherwise, use Listing 1, DISKEDT.

Disk Editor scans a disk in 256-byte blocks or on a byte-by-byte basis. It works in everyday decimal notation, so the maximum number of readers are able to make use of this article and the program.

Directory Information

A directory containing the filenames and related information is located on Track 17, from sectors 3 to 18, on all RS-DOS disks with enough space for 128 filenames. However, standard 35-track disks have a limit of 68 filenames, which extend only to Sector 11 and leave sectors 1 and 12 through 18 unused.

Each filename entry uses 32 bytes as shown in Table 1. When a file is killed, the first character of the filename is changed to a zero. The other 31 bytes of the entry (as well as the file itself) remain intact until a new file writes over them. The FAT entries (in Sector 2) for the killed file are changed to 255.

The remaining directory entries to the end of Sector 18 are filled with 255. Therefore, when you see directory entries containing 255, you have found the end of the directory.

You can trace the whole file through the file allocation table using Table 2, which converts granules to tracks and sectors.

The File Allocation Table

The file allocation table (FAT) is located on Track 17, Sector 2 and uses only sufficient entries to represent each granule used in the system (one byte per granule).

The standard system has 68 granules (0 to 67), but modified systems using 40- or 80-tracks may contain up to 158 granules. A

granule equals nine 256-byte sectors. Therefore, each track on the disk has two granules assigned to it except for the directory track (Track 17). All entries in Sector 2 that are not part of the FAT contain a value of zero.

The file allocation table consists of an array of 68 single-byte entries that represent each of the 68 granules on a one-for-one basis. That is, the first entry in the FAT is for the first granule on the disk, the second entry is for the second granule and so on. If your file is stored on more than one granule, the FAT entry contains a number from 1 to 68 that points to the next granule of the file.

The entry representing the last granule of the file contains a value from 192 to 201 ($C0 to $C9). A value of 192 ($C0) means the file exists in name only, and no sectors are allocated to this file. The values from 193 ($C1) to 201 ($C9) represent the nine sectors of a granule. For example, if the last entry in the chain is 196 ($C4), just the first four sectors of the granule are used. From a binary perspective, the two most-significant bits set in the upper nibble (1100) indicate the end of the chain, and the lower nibble indicates the number of sectors in use. Remember from above that the 16th byte of the directory entry reveals the actual number of bytes used in the last sector of the file — a value between 0 and 255.

Byte	Contents
0-7	Filename
8-10	Filename extension
11	File type 0 = BASIC program 1 = BASIC data file 2 = Machine language program 3 = Text editor source file
12	ASCII flag 00 = Binary FF = ASCII
13	Number of the first granule for the file
14-15	Number of bytes in use in the last sector of the file
16-31	Reserved for future use

Figure 1: Disk Directory Entry

Sectors 1 through 9 are always assigned to granules with an even number and are always allocated first. Sectors 10 through 18 are always assigned to odd-numbered granules and are allocated only after all the even-numbered granules are allocated.

Restoring Killed Files

There are three stages to restoring killed files. First begin by replacing the zero kill flag stored in the first byte of the filename in the directory with the first character of the actual filename. Look at the 14th byte for the starting granule number. Use the granule/track conversion table (Table 2) to find the correct track to start with. Next scan the disk and follow the file to determine all of its granule numbers. Finally, complete the restoration by replacing 255 in the FAT entries with the correct granule numbers.

Easier Said Than Done

To follow a file from granule-to-granule requires effort. For a large file it may not be worth it if you have other alternatives. You must bear in mind how the computer assigns granules. It works from the directory Track 17 alternately downward or upward, looking for available granules. It goes for an even granule number first and tries to keep all parts of a file on one side of Track 17, but gives up

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and goes to the other side if it must (if there are no available granules on the first side).

As an example, assume that the 14th byte in the directory for a killed file contains the number 31. This is Track 15, sectors 10 through 18. Scanning these sectors we find that the file continues past Sector 18. Since Track 15 is less than 17, the next granule of the file should be on a lower track. The FAT entries for Track 14 (granules 28 and 29) are not 255, meaning Track 14 is in use. But the FAT entries for granules 26 and 27 are 255. Therefore the next part of your file should be in those granules starting with Track 13, Sector 1. Change the 255 in the FAT entry for Granule 31 to 26 and continue following the file to lower-numbered tracks.

Finding the End of the File

One of the tricky aspects of tracking a file is knowing where it ends. Garbage, or data from a previously killed file, often follows at the end of the file you are tracking. This tends to obscure the end of the file. Remember that the 16th byte of the filename entry contains the exact number of bytes in the last sector of the file. Therefore when you reach the right sector, you know the exact location of the last byte.

Data files, ASCII text files and ASCII BASIC files do not have end-of-file markers. (An ASCII BASIC file is a BASIC file saved with the A option. Text files are normally generated by word processors or assemblers.) However, their contents usually make sense, so combined with the knowledge of the position of the last byte in the last sector, you should be able to see the end of the file.

ASCII BASIC and text files end each line with a carriage return (decimal 13), so it follows the last byte of such a file will also be a carriage return.

Binary BASIC files end with three zeroes. Machine language files end with a 255, two zeroes and two bytes representing the execution address.

The second and third bytes of both binary BASIC and single-segment Machine language files contain the length of the file. You multiply the number contained in the second byte of the file by 256 and add the number contained in the third byte. That is the length of the file in bytes. Since there are 2304 bytes in a granule and 256 bytes in a sector, you can easily calculate the number of granules used in the file and the number of sectors used in the last granule.

Machine language files can be made up of a number of segments joined together into one file. In this case, the second and third bytes of the file contain only the length of the first segment. Between segments there is a zero, two bytes representing the length of the next segment and two bytes for the loading address of the segment. Remember, if you do not see a 255 followed by two zeroes, you are not at the end of the file.

Granule	Track/Sectors	Granule	Track/Sectors
0	0/1-9	1	0/10-18
2	1/1-9	3	1/10-18
4	2/1-9	5	2/10-18
6	3/1-9	7	3/10-18
8	4/1-9	9	4/10-18
10	5/1-9	11	5/10-18
12	6/1-9	13	6/10-18
14	7/1-9	15	7/10-18
16	8/1-9	17	8/10-18
18	9/1-9	19	9/10-18
20	1/1-9	21	10/10-18
22	1/1-9	23	11/10-18
24	12/1-9	25	12/10-18
26	13/1-9	27	13/10-18
28	14/1-9	29	14/10-18
30	15/1-9	31	15/10-18
32	16/1-9	33	16/10-18
34	18/1-9	35	18/10-18
36	19/1-9	37	19/10-18
38	20/1-9	39	20/10-18
40	21/1-9	41	21/10-18
42	22/1-9	43	22/10-18
44	23/1-9	45	23/10-18
46	24/1-9	47	24/10-18
48	25/1-9	49	25/10-18
50	26/1-9	51	26/10-18
52	27/1-9	53	27/10-18
54	28/1-9	55	28/10-18
56	29/1-9	57	29/10-18
58	30/1-9	59	30/10-18
60	31/1-9	61	31/10-18
62	32/1-9	63	32/10-18
64	33/1-9	65	33/10-18
66	34/1-9	67	34/10-18
68	35/1-9	69	35/10-18
70	36/1-9	71	36/10-18
72	37/1-9	73	37/10-18
74	38/1-9	75	38/10-18
76	39/1-9	77	39/10-18

Table 2. Granule/Track Conversion

The Disk Editor

Disk Editor is written in BASIC and works on any CoCo. Extensive use of comments allow easy changes, but you can later edit them out (as well as most spaces) to make the program execute a little faster.

The program uses a poke to speed-up the display, but if you make changes, be sure to use the low-speed poke before any disk I/O or printing or you will have problems. High-speed pokes in lines 370, 425 and 469 and slow-speed pokes in lines 170 and 510 are for a CoCo 3. If you have a CoCo 1 or 2, change the high-speed pokes to 65495,0 and the slow-speed pokes to 65494,0.

When you run the program, all options are accessed from one screen display. If you do not see a flashing cursor, the program is waiting for you to select one of the three menu options or to press the CLEAR or the up/down arrow keys.

If you see a cursor, you must type in a response. A null entry returns you to the selection menu. The CLEAR key toggles between two modes: one to display a complete 256-byte sector at once, the other to display 64-byte segments of a sector in two lines and 16 bytes in the next six lines. These six lines show a table of the offset, the value at that offset and the ASCII character represented by that value.

The purpose of the first mode is to quickly scan through a granule 256 bytes at a time. The second mode has the detail for editing (Option 2).

Ready to Go

With the information provided here and *Disk Editor*, you are now in a position to unravel many of the mysteries of disk storage. Even if you do not have a killed file, run *Disk Editor* just to sight-see through the directory and track a file. Or you could kill a file (on a backup, of course) to try your hand at file resurrection. It will be a useful experience.

❑

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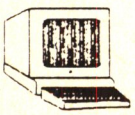

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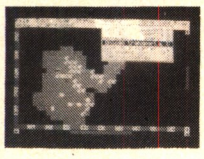

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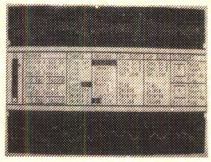

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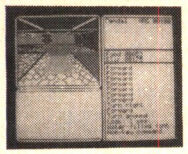

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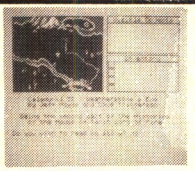

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```
 BY THE SCREEN.
115 B = 129: C = 256 ' FLAGS NO
 SETTING OF TRACKS/SECTORS (FOR
 SUBS 400 & 450)
120 CLS 'RESET THE SCREEN
130 PRINT STRING$(10,K$) "disk"
K$ "editor" STRING$(11,K$);
140 PRINT "  <1> SET TRACK/SECTO
R NUMBERS": PRINT "  <2> EDIT BY
TES DISPLAYED": PRINT "  <3> OUT
PUT SECTOR TO DISK"
150 PRINT "arrows" K$ "scroll" K
$ CHR$(124) K$ "clear" K$ "flips
" K$ "mode";
170 POKE 65496,0: EXEC44539: I$
= INKEY$: A = VAL(I$) 'CANCEL
  SPEED POKE. HOLD THE SCREEN.
  I$ AND 'A' HOLD SELECTION.
180 IF I$ = CHR$(94) THEN 400 '
 UP ARROW SELECTED.
190 IF I$ = CHR$(10) THEN 450 '
 DOWN ARROW SELECTED.
195 IF I$ = CHR$(12) THEN 230 '
 TOGGLE DISPLAY MODE SELECTED.
200 IF A < 1 OR A > 3 THEN 120 '
 OPTIONS 1 TO 3 OR INVALID KEY.
210 ON A GOTO 300,500,600
220 '
230 IF F = 0 THEN F = 1 ELSE F =
 0 'TOGGLE DISPLAY MODE FLAG.
240 PRINT @ 192, STRING$(128,32)
STRING$(128,32) STRING$(63,32);
' CLEAR THE DISPLAY AREA.
250 GOTO 350 'RE-DRAW SCREEN IN
 NEW MODE.
260 '
270 ' DISPLAY TRACK & SECTOR
275 '
280 PRINT @ 160, "  " S$;: PRINT
 @ 162, "TRACK" C$ T;:PRINT @ 17
6, "SECTOR" C$ S;: RETURN
290 '
300 ' DISK SCANNING SUBROUTINE
310 '
315 PRINT @ 160, STRING$(255,32)
 STRING$(96,32); 'CLEAR WORKING
 AREA.
320 PRINT @ 162,"TRACK" C$;: INP
UT I$: T = VAL(I$): IF I$ = "" T
HEN 120 '  INPUT TRACK NUMBER OR
 NULL TO CANCEL.
330 PRINT @ 176,"SECTOR" C$;: IN
PUT I$: S = VAL(I$): IF I$ = ""
THEN 120 '  INPUT SECTOR NUMBER
OR NULL TO  CANCEL.
350 IF S < 1 THEN S = 18: T = T
- 1 ELSE IF S > 18 THEN S = 1: T
 = T + 1 ' ALLOWS SCROLLING TO
 THE NEXT TRACK.
355 IF T < 0 THEN T = 0 ELSE IF
T > 34 THEN T = 34 ' ERROR TRAP;
 40/80 TRACK USERS EDIT TO SUIT.
357 GOSUB 270 ' RE-PRINT TRACK &
 SECTOR NUMBERS.
360 DSKI$0,T,S,X$,Y$ 'SECTOR IS
 ACCESSED FROM DISK. 128 BYTES
 AS X$ AND 128 BYTES AS Y$.
365 B = 1: C = 0: D = 0: Z$ = X$
: V$ = X$ 'RESET SEGMENT/BYTE
 COUNTERS & MAKE V$ & Z$ = THE
 FIRST INPUT VARIABLE.
370 POKE 65497,0 'SET FAST SPEED
371 A = INSTR(V$,CHR$(13)): IF A
 <> 0 THEN MID$(V$,A,1) = " ": G
OTO 371 'MAKE ALL CR'S (13) INTO
 A SPACE TO FORCE DISPLAY TO 2
 LINES OF SCREEN.
372 IF F = 0 THEN 700 'GOTO SCAN
 MODE ROUTINE.
373 PRINT @ 192, S$S$ 'CLEARS 2
 LINES OF SCREEN.
374 PRINT @ 192, MID$(V$,B,64);
 ' PRINT A 64-BYTE SEGMENT.
375 PRINT @ 288,;: FOR X = C TO
C + 7: PRINT LEFT$(STR$(X)+"  ",
4);: NEXT X 'PRINT BYTE NUMBERS
380 FOR X = C+1-D TO C+8-D: PRIN
T LEFT$(STR$(ASC(MID$(Z$,X)))+"
 ",4);: NEXT X ' PRINT THE VALUE
 OF 8 BYTES.
383 A=352: FOR X = C+1-D TO C+8-
D: PRINT @ A,"  "+MID$(V$,X,1)+"
  ";: A = A + 4: NEXT X 'PRINT
 ASCII CHAR. OF 8 BYTES.
385 C = X-1+D 'SET C FOR NEXT 8.
390 PRINT @ 416,;: FOR X = C TO
C + 7: PRINT LEFT$(STR$(X)+"  ",
4);: NEXT X 'PRINT NEXT 8 NUMS.
395 FOR X = C+1-D TO C+8-D: PRIN
T LEFT$(STR$(ASC(MID$(Z$,X)))+"
 ",4);: NEXT X 'PRINT VALUE  OF
 8 MORE BYTES.
396 A = 480: FOR X = C+1-D TO C+
7-D: PRINT @ A,"  "+MID$(V$,X,1)
+" ";: A = A + 4: NEXT X: PRINT
@ A," " MID$(V$,X,1) " ";: X = X
 + 1 '  PRINT LAST 8 ASCII CHAR.
 BYTES.
```


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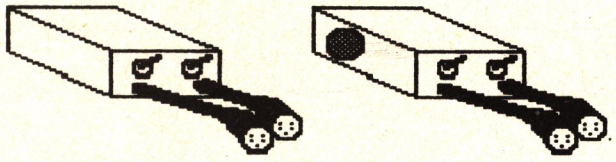
```
397 C = X-1+D: IF F1 = 1 THEN RE
TURN ELSE 170 'UPDATE COUNT.
 RETURN IF EDIT FLAG SET. ELSE
 GOTO MENU.
399 '
400 ' UP ARROW SUB
410 '
420 IF F = 0 OR C = 256 THEN S =
 S + 1: GOTO 350 ' INCREMENTS TO
 THE NEXT SECTOR.
425 POKE 65497,0 'SPEED POKE
430 IF C = 128 THEN B = 1: D = 1
28: Z$ = Y$: V$ = Y$: GOTO 370 '
 ADVANCE TO NEXT INPUT VARIABLE.
440 IF C = 64 OR C = 192 THEN B
= B + 64: GOTO 370 'DISPLAY NEXT
 64-BYTE SEGMENT AND NEXT 16
 BYTE VALUES.
445 GOTO 375 'DISPLAY NEXT 16
 BYTE VALUES.
450 ' DOWN ARROW SUB
455 '
460 IF F = 0 THEN S = S - 1: GOT
O 350 ' DECREMENTS SECTOR SCAN.
465 IF C = 16 THEN C = 240: D =
128: B = 65: S = S - 1: A = 255:
 IF S < 1 THEN S = 18: T = T - 1
: IF T < 0 THEN T = 0 '  SHIFT
 DOWN TO NEXT SECTOR. ("A" FLAGS
 NEXT LINE.)
467 IF A = 255 THEN GOSUB 270: D
SKI$0,T,S,X$,Y$: Z$ = Y$: V$ = Y
$: GOTO 370 ' PRINT TK & SECTOR
 AND GET NEXT SECTOR DOWN.
469 POKE65497,0 ' SPEED POKE
470 IF C = 144 THEN B = 65: C =
112: D = 0: Z$ = X$: V$ = X$: GO
TO 370 ' SHIFT DOWN TO IST INPUT
 VARIABLE.
475 IF C = 80 OR C = 208 THEN B
= B - 64: C = C - 32: GOTO 370 '
 DOWN BY ONE 64-BYTE SEGMENT.
480 C = C - 32: GOTO 375 'PRINT
 NEXT 16 BYTES DOWN.
490 '
500 ' EDIT BYTES SUB
505 '
510 POKE 65496,0: IF F = 0 THEN
650 ELSE PRINT @ 162, S$: PRINT
@ 160, "byte" K$ "number" C$;: I
NPUT I$: A = VAL (I$) ' CANCEL
 SPEED POKE. SELECT BYTE.
515 IF I$ = "" OR A < C - 16 OR
A => C THEN F1 = 0: GOSUB 270: G
OTO 170 ' EXITS EDIT OPTION.
520 PRINT @ 180, "value" C$;: IN
PUT I$: E = VAL(I$) 'DECIMAL
 VALUE OF BYTE.IF E <0 OR E >255
 THEN 120
525 IF I$ = "" OR E <0 OR E >255
 THEN F1 = 0: GOSUB 270: GOTO 17
0 ' EXITS EDIT OPTION.
530 MID$(Z$,A+1-D,1) = CHR$(E) '
 CHANGE THE BYTE.
540 V$ = Z$: IF C < 129 THEN X$
= Z$ ELSE Y$ = Z$ 'COPY CHANGE
 TO I/0 VARIABLES.
550 C = C - 16 'RESET BYTE COUNT
560 F1 = 1: GOSUB 370 'SET FLAG
 FOR SUB AT 370 AND RE-DRAW THE
 DISPLAY.
570 GOTO 510 'READY TO EDIT NEXT
 BYTE.
590 '
600 'SUB TO WRITE SECTOR TO DISK
603 '
604 IF X$ = "" THEN 120 ' ERROR
 TRAP. NO SECTOR IN MEMORY.
605 PRINT @ 192, STRING$(191,32)
 STRING$(128,32); 'CLEAR WORKING
 AREA.
610 PRINT @ 258, "modifying" K$
"disk   SURE? (Y/N)": EXEC44539:
 I$ = INKEY$: IF I$ <> "Y" THEN
650 ' WARNING MESSAGE.
620 DSKO$0,T,S,X$,Y$ ' SECTOR IS
 WRITTEN TO DISK.
650 IF F = 0 THEN V$ = Z$ ELSE C
 = C - 16 ' IF FULL SECTOR MODE
 RESET DISPLAY VARIABLE ELSE
 RESET THE COUNT IN BYTE MODE.
660 PRINT @ 256, S$: GOTO 370 '
 RE-DISPLAY SCREEN.
690 '
700 'SCAN ENTIRE 256-BYTE SECTOR
705 '
710 PRINT @ 192, S$S$S$S$S$S$S$
$; 'CLEAR 8 LINES ON SCREEN.
720 PRINT @ 192, V$; 'PRINT 128
 BYTES OF SECTOR.
730 V$ = Y$ 'GET NEXT SEGMENT
740 A = INSTR(V$,CHR$(13)): IF A
 <> 0 THEN MID$(V$,A,1) = " ": G
OTO 740 'REPLACE THE CR'S.
750 PRINT V$;: GOTO 170 'PRINT
 LAST 128 BYTES & BACK TO MENU.
```

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A utility to switch window types in a hurry

Type Does Windows!

by Chris Swinefurth

Have you ever been using a text window and needed to change to a graphics window to run your favorite graphics editor, but you didn't have a hard drive and the `makegw` file was on another disk? Even with a hard drive you probably don't like files cluttering up your root directory, you just *hate* to change directories, and you're tired of shell scripts that only change the window to one type. Perhaps you need *Type*, which I created in order to change the type of window selected—i.e., a graphics window, or a 40- or 80-column text window.

Type uses the following syntax:

`type [-opts]`

where the options are as follows:

Chris Swinefurth is 14 years old and is a self-taught programmer in C and BASIC. He may be contacted at R.R. 3 Box 321, Elwood, IN 46036 (317) 552-5707.

OS-9 Level II

The Listing: `type.c`

```
/* Type - A utility to change the type of window you're in.
        By: The Bug (Chris Swinefurth)
            R.R 3 Box 321
            Elwood, IN 46036

            (c)December 30,1989 Chris Swinefurth

            Version - 7
*/
#define ON      1
#define OFF     0

#define gcode(i) gp = gbuf; gbyte(0x1B); gbyte(i)
#define gbyte(i) *(gp++) = ((char) i)
#define gwrite() write(1, gbuf, gp-gbuf)

/* Main Variables */
char gbuf[15];
char *gp;
int  i;
int  type;
int  foreground = -1;
int  background = -1;
int  border = -1;
char cols[] = {0, 40, 80, 38, 80, 80, 40, 80, 40};
char label = OFF;

/* ── Start of Main ── */
```

`-t`	window type
`-f`	foreground color
`-b`	background color
`-o`	border color
`-l`	window label

Note that you must include the `-t` parameter and provide the desired window type number (see Table 1.) For example, if you want to create an 80-column text window with a foreground palette of zero (white), a background palette of one (blue), and a border palette of two (black), you would enter `type -t2 -f0 -b1 -o2`. You can put the `-l` option after the window type number: `type -t# -l` (where the # indicates the window type number). This option tells *Type* to label the window. Use this option if you want a label on the window and you have the `label` command, which is available on Delphi.

Window types 1, 2 and 5 through 8 are the standard OS-9 window types. Window Type 3 is a 38-column window for people without an 80- or 40-column monitor (yes, I've been there myself). Window Type 4 is a 106-column window, which is really a Type 7 window, but I used the smaller

```
main(argc, argv)
int  argc;
char *argv[];
{
     /* Test for Arg's */
     if(argc < 2)
          help();

     /* Loop to get Arg's */
     /* This loop allows it to put the arg's any way they want! */
     while(-argc > 0 && (*++argv)[0] == '-') {
          for(gp = argv[0] + 1; *gp != '\0'; gp++) {
               switch(*gp) {
                    case 'b':
                         background = atoi(++gp);
                         break;

                    case 'f':
                         foreground = atoi(++gp);
                         break;

                    case 'l':
                         label = ON;
                         break;

                    case 'o':
                         border = atoi(++gp);
                         break;

                    case 't':
                         type = atoi(++gp);

                         if(type == 4) {
```


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graphics font. Window Type 4 can be used for super text resolution with graphics or just to show off OS-9.

If you give the program a window type of 0, it changes the window to the default defined in the device descriptor — but only if you initialized the window via the `iniz` command. If the window was not initialized, it will be destroyed. At this point you need to `iniz` the window and run `type` with the program's standard output redirected to the window you destroyed. Also, never run the program while you are in the VDG 32-column window.

I use the program in my OS-9 startup file to change the default 40-column window to an 80-column window.

The Program

First, *Type* gets the command line arguments by using a `while/switch` loop and checks them for validity. If the arguments are correct, the window is destroyed by using the `DWEnd` ($1B 24) call and recreated by using the `DWSet` ($1B 20) call. For safety, the window is selected by using the OS-9 `Select` ($1B 21) call.

Not only does *Type* change the kind of window you are currently in, you can also redirect its output to a different window and make that window whatever kind you want. For instance, I use the program in my OS-9 startup file to change the default 40-column window (Type 1) to an 80-column window (Type 2).

The feature I like most about OS-9 is windows. I hope everyone can learn from this program. I think you should try windows at least once before concluding that OS-9 is too difficult to use.

❑

```
                              type = 7;
                              cols[0] = 1;
                         }
                         break;

                    case '?':
                    default:
                         help();
                         break;
               }
          }
     }

     /* Test window type */
     if(type <0 || type > 8)
          help();

     /* Call to Dwset to make window - dwset also dwends the window */
     dwset();

     /* Call to font - it doesn't hurt a text window to call font so to */
     /*                save mem I went ahead and called it for every */
     /*                window you make. */
     gcode(0x3A);       /* Font Call */
     gbyte(0xC8);       /* Font Buffer - Defined by: Microware */
     gbyte(cols[0] ? 2 : 1); /* Small Font for Type#4 - Reg Font for rest
*/
     gwrite();

     /* Test for Label */
     if(label)
          system("label");
}
/* ── End of Main ── */

/* dwset call - all args are external so no function args */
dwset()
{
     gcode(0x24);                    /* dwend call */
     gwrite();                       /* write it */
     gcode(0x20);                    /* dwset call */
     gbyte(type == 3 ? 1 : type);    /* type of the window */
     gbyte(type == 3 ? 2 : 0);      /* 2 cols for 38 col window - 0 for rest
*/
     gbyte(0);                       /* 0 down */
     gbyte(cols[type]);              /* columns for the window */
     gbyte(24);                      /* columns down */
     gbyte(foreground == -1 ? 0 : foreground);
     gbyte(background == -1 ? (type == 5 ? 1 : 2) : background);
     gbyte(border == -1 ? (type == 5 ? 1 : 2) : border);
     gbyte(0x1B);                   /* Escape Sequence - Adding on to buffer
*/
     gbyte(0x21);                    /* Don't forget to select the window */
     gwrite();                       /* Write it all */
}

char *helpmsg[] = {
     "type -t# {-f#} {-b#} {-o#} {-l}\n",
     "-t# = window type (0-8)\n",
     "-f# = foreground color\n",
     "-b# = background color\n",
     "-o# = border color\n",
     "-l  = label the window\n"
};

help()
{
     int i;

     for(i = 0; i < 6; i++)
          writeln(2, helpmsg[i], strlen(helpmsg[i]));
     exit(0);
}
```

CoCos Not up to Par

by Marty Goodman.
Contributing Editor

I have a CoCo 3 that gives only a blank screen when the power is turned on. No startup logo ever appears. I also have a CoCo 2 that is dead. What do you think is wrong with these machines?

Randy Praster
South Bound Brook, New Jersey

It is impossible for me to be sure of what is wrong with either of those computers without testing. However, I can speculate that the CoCo 3 has a dead 68B09E chip. Out of the last six Coco 3s I've fixed, four had fried 68B09E chips.

You need to be able to desolder this 40-pin chip without hurting the delicate traces on the circuit board, install a socket, then install a replacement 68B09E if you want to fix the machine. Don't attempt this unless you have experience with desoldering chips and delicate soldering in general.

Other problems that can plague CoCo 3s include bad GIME chips (the socketted square chip) and bad memory chips. I've seen CoCo 3s with burned-out keyboard PIA chips causing exactly the same problem you describe. Both of those were on CoCo 3s that had my custom keyboard extender cable on them, where the owners (myself in one case) played around with hooking different keyboards to that cable and managed to zap the chip with a static discharge.

As for the CoCo 2, anything could be wrong with it. Common CoCo 2 problems include dead SAM chips (74LS783 or 74LS785), dead 6809Es, bad memory chips or any combination of the above. Typically repairs on those are done by chip swapping. Note that CoCo 2s tend to sell for $25 or less at flea markets these days, and so spending much time or money repairing them is often not worth it.

Deciding on a Disk Drive

I'm ready to buy a disk drive for my CoCo 3 but wonder whether to get a 3½-inch or a 5¼-inch floppy drive. As I understand it, I can use the 3½-inch drive with normal Radio Shack Disk BASIC but will only be using the first 35 tracks on only one side. Is this so? How can I use more of such a disk drive? What is meant by "Drive 0" and "Drive 1"?

Syd Tash
Quebec

Yes, electrically the 3½-inch floppy disk drives can be hooked directly to a Tandy-style CoCo disk controller. All you need is a different type of 34-pin connector. And you are right in observing that with unmodified Radio Shack Disk Extended Color BASIC, you can only access under a quarter of the total disk storage space available on such a disk. However, with *ADOS3* or with some programs from Danosoft, you can modify Disk BASIC to work with 80-track and double-sided drives. The problem you will have is that most CoCo software is supplied only on 5¼-inch disks. So when you buy software or exchange information with other CoCo owners, you will have a problem. This can be solved by buying both a 3½-inch drive and a 5¼-inch drive and hooking both into the system. *Extended ADOS3* supports such an arrangement.

The terms Drive 0 and Drive 1 refer to different devices accessed by Disk BASIC. Often these different devices are actually two physically different disk drives. However, under *ADOS* and other modified DOSs, one often assigns one side of a double-sided disk to be one device and the other side of it to be another device. For example, most folks with two floppy disk drives under Disk BASIC set things up so that Side 0 of their first drive is Drive 0 and Side 1 of their first drive is Drive 2, with Drive 1 and Drive 3 corresponding to the 0 and 1 side of their second physical drive, respectively.

Both the 3½-inch and the 5¼-inch drives you are referring to are floppy drives. A hard drive is an entirely different animal. The disks for the 3½-inch drives are in more rigid plastic sleeves than the sleeves used to hold 5¼-inch disks. But inside those plastic sleeves on a 3½-inch disk is the same floppy mylar disk material used in a 5¼-inch disk.

Idea for Chip Extractor

I've found that I can make a GIME Chip Extractor using the common, inexpensive, U-shaped IC extractors. What I did was file down the grabbing ends of an ordinary IC extractor until they were roughly 1/8 of an inch wide instead of their usual ¼-inch width. Because the ends are small, they can fit into the diagonally opposite corner spaces between the GIME chip and its socket, making for easy extraction.

Robert Capone
Reading, Pennsylvania

Martin H. Goodman, M.D., a physician trained in anesthesiology, is a longtime electronics tinkerer and outspoken commentator—sort of the Howard Cosell of the CoCo world. On Delphi, Marty is the SIGop of RAINBOW's CoCo SIG and database manager of OS-9 Online. His non-computer passions include running, mountaineering and outdoor photography. Marty lives in San Pablo, California.

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That's a neat, clever tool you've constructed. It should work quite well. I've always managed to extract GIME chips using two jeweler's screwdrivers at opposite corners and gently levering up the chip.

CoCo 3 owners who need to remove their GIME chip should make careful note of the exact orientation of the chip before they remove it. It is not keyed, and it is possible to insert it rotated 90, 180 or 270 degrees.

Expansion Port Pin-Out

Can you give me the pin-out of the Color Computer's expansion port? I'm interested in building some of Tony DiStefano's projects described in his "Turn of the Screw" column.

Chris Long
Lapeer, Michigan

Below is a pin diagram for the Color Computer expansion port:

Pin	Function	Pin	Function
1	NC	21	A2
2	NC	22	A3
3	*HALT	23	A4
4	*NMI	24	A5
5	*RESET	25	A6
6	ECLK	26	A7
7	QCLK	27	A8
8	*CART	28	A9
9	+5 volts	29	A10
10	D0	30	A11
11	D1	31	A12
12	D2	32	*CTS
13	D3	33	Ground
14	D4	34	Ground
15	D5	35	SND
16	D6	36	*SCS
17	D7	37	A13
18	R/*W	38	A14
19	A0	39	A15
20	A1	40	*SLENB

Note that this information plus a full schematic diagram for the CoCo is available in the service manual for the Color Computer. I suggest that anyone doing hardware projects for the CoCo have this manual on-hand for their CoCo model. Also note that pins 1 and 2 carry minus (-) and plus (+) 12 volts, respectively, on the port of the CoCo 1 and on the 40-pin connector of both the old and newer Multi-Pak Interfaces. NC above means not connected to anything.

Your technical questions are welcomed. Please address them to CoCo Consultations, THE RAINBOW, P. O. Box 385, Prospect, KY 40059.

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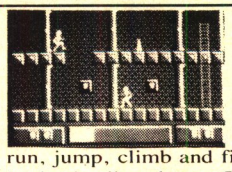

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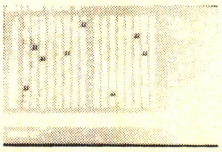

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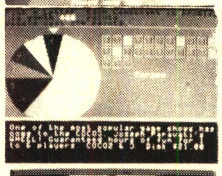

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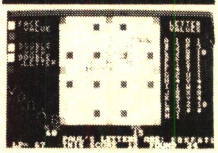

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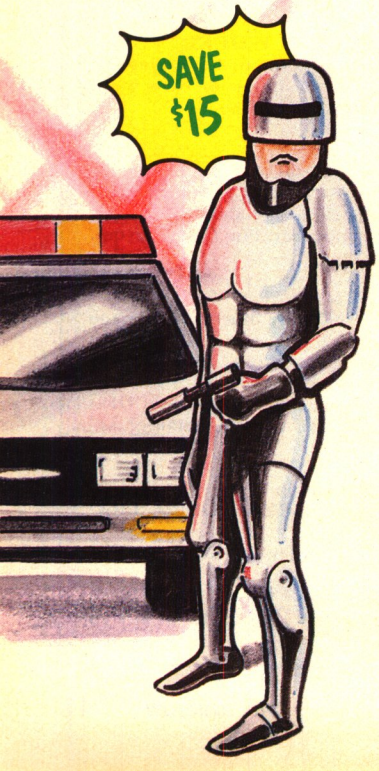

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Scaling the Directory Tree

by Greg Law
Technical Editor

This is a continuation of last month's discussion, which covered in detail the basic structure of directories. As a follow-up, let's look at how the directories are linked. First, we'll create a sample disk.

With your OS-9 System Disk in the drive, type `load format dir makdir` and press ENTER. Remove your system disk, insert a blank disk and type `format /d0`. When the disk has finished formatting, type `dir`. Nothing there, right? So far there is nothing on the disk except for an empty directory. This is called the root directory because it is the base, or foundation, from which other directories are built. Let's begin adding some directories by typing `makdir CMDS` and `makdir TEMP`, pressing ENTER after each command. Type `dir` again and see that we now have two directories on the disk. Enter `chd TEMP` to make `TEMP` the *current data directory* — the one in which we'll work next. If you enter `dir`, you'll see `TEMP` is currently empty. Now create two subdirectories within `TEMP` by entering `makdir FILES` and `makdir PWDIR`. Go ahead and make `/D0/TEMP/PWDIR` the current data directory by entering `chd PWDIR`.

Right now our directories are three levels deep. On the first level we have the root directory (`/D0`). The second level contains `CMDS` and `TEMP`, and the third level contains `FILES` and `PWDIR`. Figure 1 shows the directory layout as an organizational chart. The president is at the top, the various department heads are under him in the second level and the area supervisors are in the third level.

In addition to being OS-9 Online SIGop, Greg Law enjoys programming on all types of computers and has worked on systems ranging from the CoCo to the Burroughs B6700 super mainframe. He lives in Louisville, Kentucky.

The Crumbs

Each directory on the disk has two special entries, dot-dot (`..`) and dot (`.`). Long ago someone in the UNIX world had the crazy idea that these two entries look like cookie crumbs. Needless to say, they've been called crumbs ever since. In order to take a closer look at these two entries, we'll need to modify the `files` program presented last month. Load `files.b09` into BASIC09 and delete everything from `SEEK #Drice_PN,Offset` through `NEXT Count`, and insert the following line in its place:

```
PRINT USING"S18,H2,H2,H2",Filen
ame,Dir_Entry.LSN(0),Dir_Entry
.LSN(1),Dir_Entry.LSN(2)
```

Turn your printer on and make sure it is online. From the BASIC09 prompt enter `chd /D0` and `run files >/p`. Now enter `chd TEMP` followed by `run files >/p` and `chd PWDIR` followed by `run files >/p`. If all goes well, you should have four entries in the root directory: dot-dot, dot, `CMDS` and `TEMP`.

The numbers printed to the right of each directory entry are logical sector numbers. The dot entry contains the logical sector number of the current directory, and the dot-dot entry contains the logical sector number of the parent directory.

Try this experiment. Type `save /d0/temp/files/files.b09` and exit BASIC09. Type `chd /D0/TEMP/FILES` followed by `dir`. If you type `dir .` you'll see a directory listing of the same directory. If you type `dir ..` you'll see a directory listing of the parent directory, `/D0/TEMP`. What would happen if you typed `dir ...`? Try it and you'll see a directory listing of the root directory, which is two levels up. Each dot represents one level up the chain. This is actually a shorthand method OS-9 allows you to use. In MS-DOS, `dir ...` would be `dir ../..` because MS-DOS doesn't recognize the shorter sequence.

Refer to Figure 2 and you will see that, according to its entry in the root directory, the `CMDS` directory is located at LSN $00000A and the dot entry in the `CMDS` directory is also LSN $00000A. As the arrows indicate, the entries in the parent directory always match the dot entries in its own directory. Look at Figure 3; all the dot-dot entries contain the logical sector number of the parent directory. For example, the root directory is at LSN $00002, and the dot-dot entries in both the `CMDS` and `TEMP` directories are LSN $000002.

This is commonly called a *doubly-linked list*, meaning that each directory has both a forward link and a reverse link. As I've shown in the figures, the directory entries point forward to the dot entries of the subdirectory. Likewise, the dot-dot entries of the subdirectory point backward to the dot entry of the parent directory.

Following the Chain

So, how does OS-9 know where each directory is located? If you get lost in a tangle of directories, you can type `pwd` and OS-9 will tell you exactly which directory you are in, right down to the drive. Is OS-9 so smart that it can remember which directories you are moving around in? Actually, OS-9 has no idea which directory you are in so it goes looking to find out.

Presume for the moment that you are in the `/D0/TEMP/PWDIR` directory. The first step is to open the current directory and read the dot entry. According to the dot entry the current directory is located at LSN $000025. The next step is to open the parent directory and read each entry until you find one that has $000025 for the LSN value. When you find it you know the name of the current directory, which is `PWDIR`. To find the name of the parent directory read the dot entry in the parent directory. Then open the parent-parent directory and search

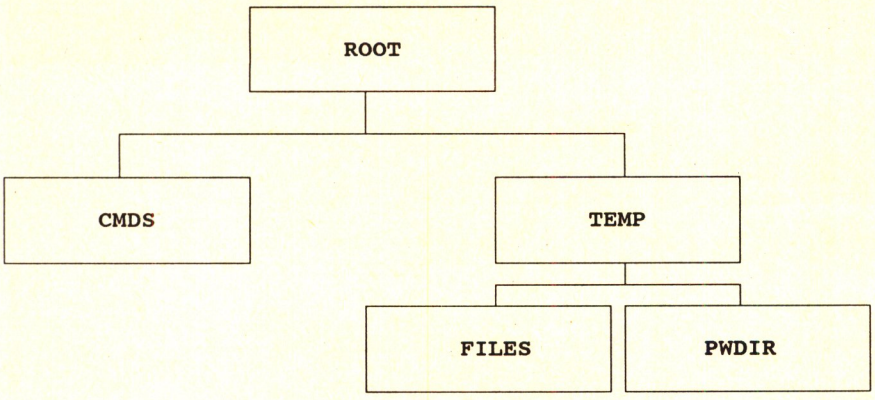

Figure 1: Sample Directory Tree Structure

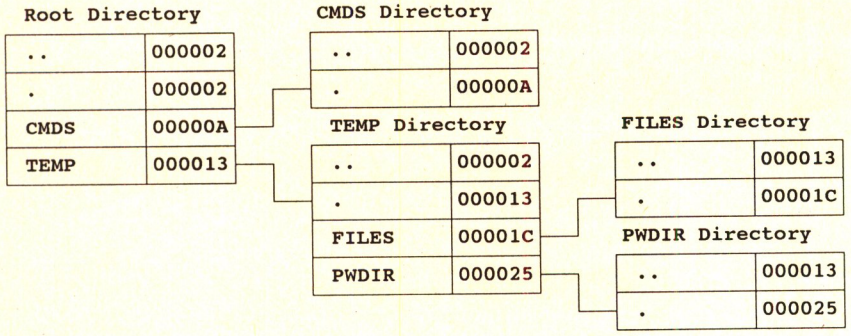

Figure 2: Directory Entry Forward Links

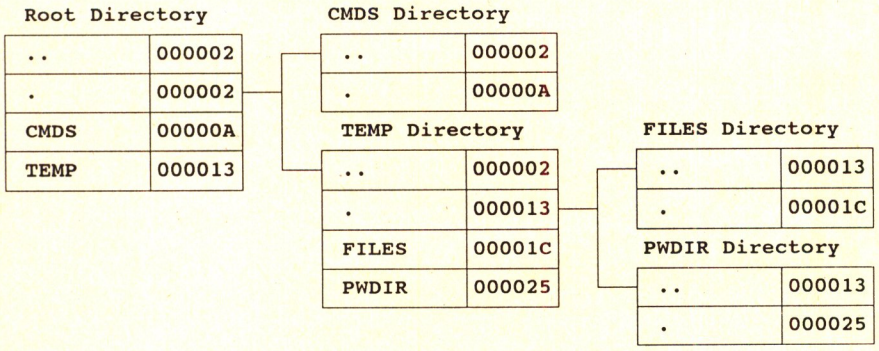

Figure 3: Directory Entry Reverse Links

for the entry with the matching LSN value. Continue doing this, going one level up the chain each time.

How do you know when to stop? Look at the figures again. See anything obvious? Both the dot and dot-dot entries in the root directory have the same values for the logical sector number. They will never

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match in any other directory unless your disk has really been scrambled. Since the root directory begins the chain, it does not have a parent directory.

How do you open the current directory? In BASIC09 you would use the command `OPEN #Path,".":DIR+READ`. To open the parent directory you would use `OPEN #Path,"..":DIR+READ`. By the same token, you can open the parent's parent directory by using `OPEN #Path,"...":DIR+READ`. For each directory up the chain, append a single period to the filename. You can obtain the name of the disk descriptor by using the `SS.DevNm` Get Status call.

You might actually look at each directory as a simple structure. As such we have the physical directory entries themselves defined in C as follows:

```
typedef struct DIR_ENTRY {
   char Filename[29];
   char LSN[3];
};
```

Each directory contains an unspecified number of entries. There will be at least two entries (dot-dot and dot), but the maximum is limited only by the amount of disk space available. You can determine the maximum number of entries in a directory by obtaining the size of the directory and dividing by 32, which is the size of each entry. As such, a directory might be defined by the following structure, where `MAX_ENTRIES` is an arbitrary number:

```
struct Directory {
   DIR_ENTRY    ParentDirectory;
   DIR_ENTRY    CurrentDirectory;
   DIR_ENTRY
Entries[MAX_ENTRIES];
};
```

The filenames may or may not use all 32 characters available. For this reason each filename is terminated by setting the most-significant bit in the last character of the filename. This is accomplished by ORing the last character with $80 (decimal 128). Examine the `strhcpy` routine presented last month for further details. If a directory entry is unused or if you delete a file, the first byte in the filename field will be zero.

The Listing

The majority of the work is performed by the `do/while` loop. The first step obtains the LSN values of the dot and dot-dot entries, closes the directory, appends a period to the filename, and opens whichever directory the name refers to. If we are not at the root directory, the name of the current directory is stored in an array.

The `Find_Offset()` function reads each

The Listing: `pwdir.c`

```
#include <os9.h>
#include <stdio.h>

#define _DIR   0x80
#define _READ  0x01
#define MAX_STACK   30

int  StackPointer;
char stack[MAX_STACK][30];

struct {
     char      FileName[29];
     char      LSN[3];
} DirEntry;

main()
{
     int       dir_pn;
     char      dir_name[30];
     long      dot_LSN;
     long      dot_dot_LSN;

     long      Find_Offset();
     char      *Find_Name();

     StackPointer = 0;
     strcpy(dir_name, ".");

     if((dir_pn = open(dir_name, _DIR+_READ)) == EOF) {
          fprintf(stderr, "Cannot open current data directory.\n");
          exit(errno);
     }

     do {
          dot_LSN = Find_Offset(dir_pn, ".");
          dot_dot_LSN = Find_Offset(dir_pn, "..");
          close(dir_pn);
          strcat(dir_name, ".");

          if((dir_pn = open(dir_name, _DIR+_READ)) == EOF) {
               fprintf(stderr, "Cannot open directory \"%s\".\n", dir_name);
               exit(errno);
          }

          if(dot_LSN != dot_dot_LSN)
               Push(Find_Name(dir_pn, dot_LSN));
     } while(dot_LSN != dot_dot_LSN);

     Print_Pathlist(dir_pn);
}

long Find_Offset(dir_pn, name)
int  dir_pn;
char *name;
{
     char filename[30];
     long offset;

     lseek(dir_pn, 0L, 0);

     while((read(dir_pn, &DirEntry, sizeof(DirEntry))) > 0) {
          strhcpy(filename, DirEntry.FileName);
          l3tol(&offset, DirEntry.LSN, 1);

          if((strcmp(filename, name)) == 0)
               return(offset);
     }
     return(0L);
}

char *Find_Name(dir_pn, lsn)
int  dir_pn;
long lsn;
{
     static char    filename[30];
     long offset;

     lseek(dir_pn, 0L, 0);

     while((read(dir_pn, &DirEntry, sizeof(DirEntry))) > 0) {
          strhcpy(filename, DirEntry.FileName);
          l3tol(&offset, DirEntry.LSN, 1);

          if(lsn == offset)
               return(filename);
     }
     return((char *) 0);
```

directory entry until it finds the filename that was passed to it. If the filename is found, it returns the logical sector number stored in that entry, otherwise it returns a value of zero. As explained previously, OS-9 uses a three-byte LSN, but the C compiler uses a four-byte long integer. Therefore we use the `l3tol()` function to convert the three-byte logical sector number to a long integer.

The `Find_Name()` function is similar except it reads each directory entry until it finds an entry with the same logical sector number that was passed to it. If it finds a matching logical sector number, it returns the filename, otherwise it returns an empty string. The `Find_Offset()` function is used to obtain the logical sector number of the dot and dot-dot entries, and the `Find_Name()` function is used to find the directory name that matches the dot entry.

The `Push()` function simply copies the filename passed to it into an array. We are actually building the pathlist backward so the first entry in the array is the last directory name in the pathlist. For that reason the `Print_Pathlist()` function prints the last name in the array first and traverses backward to the beginning of the array. ❑

```
}

Push(name)
char *name;
{
     if(StackPointer < MAX_STACK) {
          strcpy(stack[StackPointer++], name);
     } else {
          fprintf(stderr, "Directory name stack full.\n");
          exit(0);
     }
}

Print_Pathlist(dir_pn)
int  dir_pn;
{
     char buffer[30];
     char name[30];

     _gs_devn(dir_pn, buffer);
     strhcpy(name, buffer);
     printf("/%s", name);

     while(StackPointer--)
          printf("/%s", stack[StackPointer]);
     printf("\n");
}

_gs_devn(dir_pn, buffer)
int  dir_pn;
char *buffer;
{
     struct registers regs;

     regs.rg_a = dir_pn;
     regs.rg_b = 14;
     regs.rg_x = buffer;
     _os9(I_GETSTT, &regs);
}
```


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CoCo 3

Letters & Numbers

by Robert I. Mills

Letters & Numbers is a short program for the CoCo 3 designed to help youngsters recognize letters and numbers as they are displayed on the screen and to find the corresponding keys on the keyboard.

It was originally written for my 3-year-old grandson who wanted to "do something on the 'puter," and it included only letters of the alphabet. Shortly after his fourth birthday, he asked that numerals be included.

The program randomly selects a character and, if it is a letter, presents it in both upper- and lowercase. It then asks you to press the corresponding key. A correct response results in a series of ascending tones and a congratulatory message. A new character is then presented. An incorrect response results in a shorter series of descending tones and NO NO NO appears on the screen. The same character stays on the screen until the correct key is pressed.

The program has been well-received by my grandchildren, who are ages 3 to 7. They feel they are really doing something on the 'puter — and they are.

Easy modifications can be made to allow the program to run on a CoCo 1 or 2. Delete lines 50 and 70. Change LOCATE*n,n* to the appropriate PRINT@ in lines 80, 90 and 120. If your computer displays lowercase in reverse video, you may also want to delete the second semicolon and all those following it in Line 140.

The Listing: LETRSNUM

```
0 ' COPYRIGHT 1990  FALSOFT,INC
10 'LTRS&NUM
20 'BY ROBERT I. MILLS
30 'BOX 464
40 'HANOVER, IL 61041
50 ON ERR GOTO 60
60 CLS
70 WIDTH40
80 LOCATE17,5:PRINT"LETTERS"
90 LOCATE17,6:PRINT"——"
100 A=RND(90)
110 IF A<48 GOTO100
120 IF A=>58 AND A<=64 THEN 100
130 LOCATE7,10
140 PRINT"Press this key: ";CHR$
(A);"  ";:IF A <=57 THEN 150 ELS
E PRINT CHR$(A+32)
150 LOCATE17,15:LINEINPUT"—>
";A$:IF A$=""THEN150
160 B=ASC(A$)
170 IF B=> 97 THEN B=B-32
180 IF B=A THEN PRINT:PRINT"CORR
ECT! CORRECT! CORRECT! CORRECT!
YEA!" ELSE 200
190 FOR N=15 TO 200 STEP5:SOUND
N,1:NEXT:CLS:GOTO80
200 PRINT:PRINT:PRINT"NO NO NO":
FOR N=150 TO 15 STEP -5:SOUND N,
1:NEXT:GOTO 150
```

CoCo 3

Superpoke

by Geoff Friesen

The POKE command places a single byte in a single-memory location. *Superpoke* is a program that modifies the POKE command so it can place several bytes in successive memory locations. This feature allows programs that use many pokes to run faster and take up less memory.

The syntax for the new POKE command is as follows:

POKE *address*, *byte*[, *byte*]

Everything between the brackets can be repeated several times.

The listing contains a practical example that changes the OK prompt to a $ prompt. Lines 260 and 270 make use of the enhanced POKE command.

Superpoke requires the LPOKE command in lines 210 and 220 and runs only on a CoCo 3.

The Listing: SUPRPOKE

```
0 ' COPYRIGHT 1990  FALSOFT,INC
100 REM ——
110 REM SUPERPOKE
120 REM ——
130 FOR I=&H8023 TO &H8041
140 READ B$
150 POKE I,VAL("&H"+B$)
160 NEXT I
170 DATA BD,B7,3D,9F,2B,BD,B2,6D
180 DATA BD,B7,0B,9E,2B,E7,80,BF
190 DATA 00,2B,C6,2C,E1,9F,00,A6
200 DATA 26,04,9D,9F,20,EA,39
210 LPOKE &H7AB8B,&H80
220 LPOKE &H7AB8C,&H23
230 REM ————————
240 REM CHANGE OK PROMPT TO $
250 REM ————————
260 POKE &H8042,36,32,0
270 POKE &HAC77,&H80,&H41
280 POKE &HAC85,&HF0
290 POKE &HAC91,&HE4
300 POKE &HACEE,&H87
```

CORRECTIONS

***CoCo Gallery On Disk*:** Volume 1 and 2 of the CoCo 3 version will not load the individual pictures from disk if you are using a CoCo 3 with *ADOS* or Disk BASIC 2.0 (what appears as Disk BASIC 1.0 on the CoCo 1 and 2). The menu aborts with a UL Error in Line 3 and the BASIC program completely vanishes from memory. If you are experiencing this problem and are using Disk BASIC 2.0 or ADOS, make the following change in Line 142 of MENU.BAS:

```
142 IF CP=0 THEN LOADM"NIBLOAD":
POKE &HE76,&HCE:POKE &HE77,&HE7
```

16K Extended

Solving Quadratic Equations

by William Flinn

Many of us have struggled through algebra classes wondering when all the graphing and factoring of quadratic equations would end. It was only after teaching us the tedious methods of factoring that the instructor would finally divulge the secrets of the quadratic formula — a simple yet quick method of solving quadratics.

The quadratic equation, taking the form of $ax^2 + bx + c = 0$, is used for solving many different kinds of complex problems. This equation provides what becomes the graphics representation of hyperbolas, parabolas and even circles. But to plot the points on the graph paper requires that you first solve the quadratic equation to find the numerical solutions for the x and y coordinates.

A quadratic equation has one, two or no real solutions, depending on the coefficients a, b and c specified in the equation $ax^2 + bx + c = 0$. Thus the quadratic formula comes into play and solves these equations in a few easy steps. Given the form:

$$\frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

the coefficients can be plugged in place of a, b and c, and the solution(s) can be obtained. Sometimes the square root of (b^2 - 4ac) is a negative number, in which case there are no real solutions.

As shown by the program listing, each element of the quadratic formula is broken down so only two terms are dealt with at a time. Just load and run QUADRATC, and the menu takes you through the steps of solving a quadratic equation by first asking you to input each of the three coefficients. If there are valid solutions, the program displays them. If no real solutions exist, the program states so and prompts you to try another equation. Simply press Y or N to continue or stop the program.

The program runs on any Color Computer with Extended Color BASIC, with or without disk drives.

The Listing: QUADRATC

```
0 ' COPYRIGHT 1990  FALSOFT,INC
10 CLS
20 PRINT" THIS PROGRAM SOLVES QU
ADRATIC   EQUATIONS USING THE QU
ADRATIC   FORMULA."
25 PRINT
30 INPUT" COEFFICIENT A:";A
40 INPUT" COEFFICIENT B:";B
50 INPUT" COEFFICIENT C:";C
60 J=4*A*C
70 K=B*B
80 L=K-J
81 IF L<0 THEN PRINT"  THERE ARE
 NO REAL SOLUTIONS     TO THIS Q
UADRATIC EQUATION.":GOTO 190
90 M=SQR(L)
100 N=-B+M
110 O=2*A
120 P=N/O
130 Q=-B-M
140 R=Q/O
150 PRINT
160 PRINT" 1ST SOLUTION:";P
170 PRINT" 2ND SOLUTION:";R
180 PRINT
190 INPUT"DO YOU WISH TO SOLVE A
NOTHER";A$
200 IF A$="Y" THEN10 ELSE IFA$="
N" THEN END
```


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A scrambled-word game for CoCos 1, 2 and 3

CoCo Jumble

By Shane Messer

CoCo Jumble is a BASIC word game designed for the CoCo 1, 2 and 3. This game is for people of all ages and can be used as a vocabulary and spelling aid for younger children. I wrote two versions of *CoCo Jumble*. Version 2, presented here, runs on any CoCo with at least 32K and Disk BASIC. Because of its length, Version 1, which takes advantage of the CoCo 3's extended capabilities, is not printed in the magazine but is included on this month's RAINBOW ON TAPE/DISK.

The program is designed for two players but can be played by only one. To play you need a CoCo, a disk drive and, if you are running Version 1, joysticks.

The object of the game is to score points by forming words that cross and interlock on the game board. The score you receive is based on the combined point values of the letter tiles placed on the board and the point values of the positions where the tiles are placed. A listing of letter point values is shown in Figure 1. A handy feature of *CoCo Jumble* is the ability to save games and load them later to finish playing.

Getting Started

Enter the listing and save it to disk as **JUMBLE2**. Make sure the program, whichever version you use, is saved on a disk with at least three extra free granules. This gives you the room you'll need if you decide to save a game.

After you run *CoCo Jumble*, you see a title screen; then the playing screen pops up. While Version 2 picks the players' letters for them, Version 1 players can use the joystick to select their seven tiles. Once the letters are selected, the top right-hand

A -- 1 **N** -- 1
B -- 3 **O** -- 1
C -- 3 **P** -- 4
D -- 3 **Q** -- 10
E -- 1 **R** -- 4
F -- 4 **S** -- 2
G -- 2 **T** -- 3
H -- 5 **U** -- 2
I -- 1 **V** -- 6
J -- 6 **W** -- 4
K -- 6 **X** -- 10
L -- 2 **Y** -- 6
M -- 2 **Z** -- 10

Figure 1: Letter Values

Shane Messer is 14 years old and has worked on the CoCo for two years. He attends Lincoln Park Academy, and his interests include mathematics, science and playing soccer. Shane can be contacted at 3625 Orange Avenue, Ft. Pierce, FL 34947. Please enclose an SASE when requesting a reply.

side of the screen changes and the program displays the main menu.

The game board in both versions is visible at the left side of the screen. The players' letters are displayed at the bottom left side. However, they are not displayed at all times, which prevents your opponent from taking a peek.

Game Play

Selecting V from the menu lets you view your letters. The program prompts you to press any key. Once you do this, your letters appear. Press any key to return to the menu.

The S and L selections allow you to save and load a saved game, respectively. No provision is made for unique filenames (the program always uses SAVEGAME/DAT), so make sure you save only one game on any particular disk. Make sure to load a game only when no tiles are present on the board, otherwise the game will crash.

Press N to pass, turning game play over to the other player. This is handy when playing solitaire.

To enter a word on the game board, press E (press P if you are running Version 1 for the CoCo 3.) Use the arrow keys or joystick (Version 1) to select a starting position for your word. The first word can be placed anywhere on the board except on the outer edge. After this, the program asks if you want the word to run down (vertical) or across (horizontal) the board. Now you can enter a word, using only letters from the tiles you have selected. As you type, you don't have to enter letters where your word crosses others. The program automatically skips to the next appropriate position. The * tile represents a wildcard letter and has a point value of 2. Using all seven tiles earns you a bonus of 80 points.

The S and L selections allow you to save and load a saved game, respectively. No provision is made for unique filenames so make sure you save only one game on any particular disk.

If you make a mistake, press F1 to erase your word and start again. Pressing F2 erases the word and returns you to the menu without passing play to the other player. If you don't have F1 and F2 on your keyboard, use the 1 and 2 keys in their place after you make the following modifications:

```
1040 IF A$="1" OR A$="2" THEN FO
R A=1 TO N:  IF WD$>"" THEN GOSU
B 1100:NEXT A
1050 IF A$="2" THEN RETURN
```

When you are finished typing your word, press ENTER. If you don't see the cursor after a few seconds, your word is not placed correctly (it isn't crossing or touching an existing word.) If all is OK, the program jumps to the main menu and your score is displayed.

You can change your tiles during game play by pressing C. After changing letters, your turn is automatically passed and your opponent gets to play.

Pressing Q at the menu lets you quit the game. You are asked if you are sure. You are also given the option of loading or saving games.

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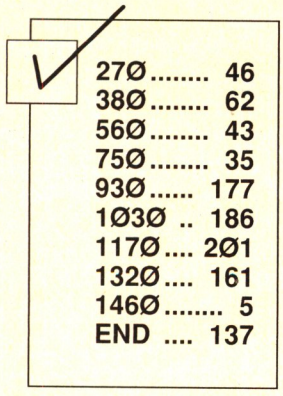
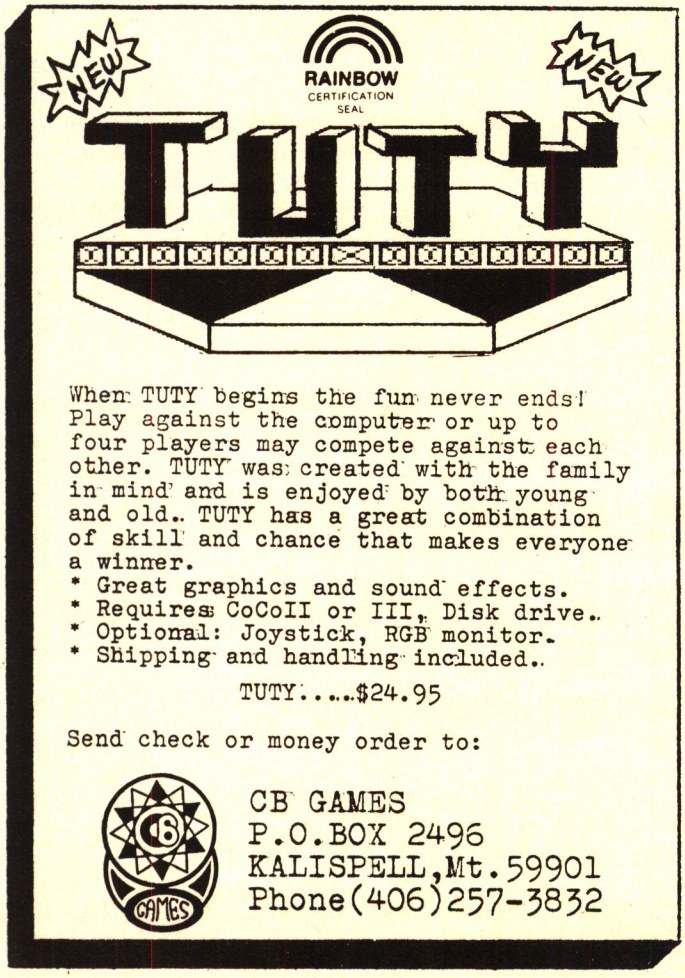


The Listing: JUMBLE2

```
10 '**************************
20 '**** COCO JUMBLE V 2.0 ****
30 '*** COPYRIGHT (C)  1989 ***
40 '**    BY FALSOFT, INC.    **
50 '*   ALL RIGHTS RESERVED    *
60 '**       - - - - -        **
70 '***      WRITTEN BY:      ***
80 '****   SHANE  MESSER    ****
90 '**************************
100 GOSUB 1450
110 FOR V= 1 TO 500:NEXT V
120 '
130 CLEAR 1000:DIM C$(9),D$(18),
E$(16,16),V(26)
140 GOSUB 210
150 GOSUB 430
160 GOSUB 270
170 GOSUB 350
180 GOSUB 580
190 GOTO 170
200 '
210 'TITLE SUBROUTINE
220 P=1
230 CLS:PRINT:PRINT:PRINT:FOR I=
1 TO 10:READ I$
240 A=LEN(I$):A=32-A:A=A/2:A=INT
(A):PRINTSTRING$(A," ");:FOR A=1
 TO LEN(I$):PRINTMID$(I$,A,1);:I
F I=1 AND MID$(I$,A,1)<>" " THEN
 PLAY"V30T25503L255EA"
250 NEXT A:PRINT:NEXT I
260 RETURN
270 'SCREEN SETUP
280 FOR B=1 TO 8:READ D$(B):D$(1
6-B)=D$(B):NEXT
290 FOR A=1 TO 26:READ V(A):NEXT
 A
300 FOR A=1 TO 15:FOR B=1 TO 15:
L$=MID$(D$(A),B,1)
310 IF L$="R" THEN PRINT CHR$(19
1); ELSE IF L$="P" THEN PRINT CH
R$(255); ELSE IF L$="B" THEN PRI
NT CHR$(175); ELSE IF L$="L" THE
N PRINT CHR$(223); ELSE PRINT CH
R$(128);
320 IF RR=1 THEN RETURN
330 NEXT B:PRINT:NEXT A
340 RETURN
350 ' CLEAR AND PRINT MENU
360 PRINT @16,"    C O C O";:PRI
NT@48,"  J U M B L E ";:PRINT@80
,"  WRITTEN BY:";:PRINT@112," SH
ANE  MESSER";:PRINT@239,"- - - -
 - - - -";
370 GOSUB 890
380 X=271:PRINT@X,"(V)IEW LETTER
S";:X=X+32:PRINT@X,"(L)OAD - (S)
AVE";:X=X+32:PRINT@X,"(E)NTER WO
RD";:X=X+32:PRINT@X,"(N)EXT PLAY
ER";:X=X+32:PRINT@X,"(C)HANGE LE
TTERS";:X=X+32:PRINT@X,"(Q)UIT G
AME";:X=X+64:PRINT@X+3,"PLAYER -
>";:IF P=1 THEN PRINT"1";
390 IF P=2 THEN PRINT"2";
400 X=X-32:PRINT@X,"- - - - - -
- - -";
410 EXEC 44539:A$=INKEY$
420 IF INSTR("LSCNQVE",A$)>0 THE
N RETURN ELSE 410
430 GOSUB 550
440 P=1:GOSUB 680:P=2:GOSUB 680:
P=1:RETURN
450 DATA C O C O  J U M B L E ,,
JUST FOR THE COCO 1 AND 2 !!!,,W
RITTEN BY SHANE MESSER,"COPYRIGH
T (C), 1989",BY FALSOFT,,,"PLEAS
E WAIT...."
460 DATA RWWLWWWRWWWLWWR
470 DATA WPWWWBWWWBWWWPW
480 DATA WWPWWWLWLWWWPWW
490 DATA LWWPWWWLWWWPWWL
500 DATA WWWWPWWWWWPWWWW
510 DATA WBWWWBWWWBWWWBW
520 DATA WWLWWWLWLWWWLWW
530 DATA RWWLWWWPWWWLWWR
540 DATA 1,3,3,2,1,4,2,5,1,6,6,2
,2,1,1,4,10,4,2,3,2,6,4,10,6,10
550 LL$="AAAAAAAAABBBBCCCDDDDEEE
EEEEEEEEFFFGGGHHIIIIIIIIIJJKLLL
LMMNNNNNNOOOOOOOOPPQRRRRRRSSSSST
TTTTUUUUVVVWWXYZ**":RETURN
560 '
570 NEXT
580 IF A$="Q" THEN GOSUB 660
590 IF A$="V" THEN GOSUB 810
600 IF A$="N" THEN GOSUB 860
610 IF A$="E" THEN GOSUB 900
620 IF A$="C" THEN GOSUB 1290
630 IF A$="S" THEN GOSUB 1390
640 IF A$="L" THEN GOSUB 1440
650 RETURN
660 X=271:FOR A=1 TO 6:PRINT@X,"
                    ";:X=X+32:NEXT:X
=271:PRINT@X," ARE YOU SURE?";:P
RINT@X+32,"      Y/N";
670 EXEC 44539:B$=INKEY$:IF B$="
Y" THEN CLS:END:ELSE IF B$="N" T
HEN RETURN ELSE 670
680 'REPLACE LETTERS FOR PLAYER
690 N=0
700 IF P=1 THEN X$=P1$ ELSE IF P
=2 THEN X$=P2$
710 IF X$="" THEN X$="        "
720 FOR A=1 TO 7:IF MID$(X$,A,1)
=" " THEN N=N+1:NEXT A
730 FOR A=1 TO N
740 IF LL$=STRING$(105," ") THEN
 1460
750 V=RND(105):IF MID$(LL$,V,1)=
" " THEN 750
760 FOR I=1 TO 7:IF MID$(X$,I,1)
=" " THEN MID$(X$,I,1)=MID$(LL$,
V,1):GOTO 770 ELSE NEXT I
770 MID$(LL$,V,1)=" ":NEXT A
780 IF INSTR(X$," ")>0 THEN 710
790 IF P=1 THEN P1$=X$ ELSE P2$=
X$
800 RETURN
810 GOSUB 880
820 X=272:PRINT@X,"READY  PLAYER
";STR$(P);
830 EXEC 44539:A$="":X$=""
840 X=X+64:IF P=1 THEN X$=P1$ EL
SE X$=P2$
850 FOR A=1 TO 7:A$=A$+MID$(X$,A
,1)+" ":NEXT:PRINT@X+1,A$:EXEC 4
4539:GOSUB 880:RETURN
860 IF P=1 THEN P=2 ELSE P=1
870 RETURN
880 X=271:FOR A=1 TO 6:PRINT@X,"
                    ";:X=X+32:NEXT A
:RETURN
890 PRINT@143,"- - - - - - - - -
";:PRINT@175,"PLAYER 1 ->"+STR$(
S1);:PRINT@207,"PLAYER 2 ->"+STR
$(S2);:RETURN
900 C$=CHR$(207)
910 X=8:Y=8
920 A$=INKEY$:GOSUB 960:IF A$=""
 THEN 920
930 IF A$="^" THEN Y=Y-1:ELSE IF
 A$=CHR$(9) THEN X=X+1 ELSE IF A
$=CHR$(8) THEN X=X-1 ELSE IF A$=
CHR$(10) THEN Y=Y+1 ELSE IF A$=C
HR$(13) THEN GOTO 970 ELSE 920
940 IF X>15 THEN X=1 ELSE IF X<1
 THEN X=15 ELSE IF Y<1 THEN Y=15
 ELSE IF Y>15 THEN Y=1
950 GOTO 920
960 YY=(Y-1)*32:XX=X-1:L=YY+XX:A
=PEEK(L+1024):POKE L+1024,ASC(C$
):POKE L+1024,A:RETURN
970 RO=RO+1:X1=X:Y1=Y:IF P=1 THE
N X$=P1$ ELSE X$=P2$
980 IF (X1=15 OR X1=1 OR Y1=15 O
R Y1=1) AND RO=1 THEN RO=RO-1: G
OTO 900
990 WD$="":DD=0:SS=0:PRINT@480,"
(S)IDE - (D)OWN";:EXEC 44539:A$=
INKEY$:IF A$="D" THEN DD=1 ELSE
IF A$="S" THEN SS=1 ELSE 990
1000 IF DD=1 AND SS=1 THEN 990 E
LSE IF DD=0 AND SS=0 THEN 990
1010 EXEC 44539:A$=INKEY$
1020 IF A$=CHR$(8) AND WD$>""THE
N GOSUB 1100:GOTO 1010
1030 N=0:IF A$="g" OR A$=CHR$(4)
 THEN FOR I=1 TO LEN(WD$) :IF MI
D$(WD$,I,1)< CHR$(255)  THEN N=N
+1:NEXT I
1040 IF A$="g" OR A$=CHR$(4) THE
N FOR A=1 TO N:IF WD$>"" THEN GO
SUB 1100:NEXT A
1050 IF A$=CHR$(4) THEN RETURN
1060 IF A$=CHR$(13) THEN GOSUB 1
520:IF GG=1 THEN 1150
1070 IF E$(X,Y)<>"" THEN GOSUB 1
610
1080 IF X<16 AND Y<16 AND INSTR(
X$,A$)>0 THEN E$(X,Y)=A$:POKE 10
24+X-1+((Y-1)*32),ASC(A$):X=X+SS
:Y=Y+DD:WD$=WD$+A$:MID$(X$,INSTR
(X$,A$),1)=" ":ELSE SOUND 1,1
1090 GOTO 1010
1100 K=LEN(WD$)
1110 IF MID$(WD$,K,1)=CHR$(255)
THEN WD$=LEFT$(WD$,K-1):X=X-SS:Y
=Y-DD:K=K-1:GOTO 1110 ELSE 1120
1120 PRINT@X-SS+((Y-DD-1)*32)-1,
```

```
"";:L$=MID$(D$(Y-DD),X-SS,1):RR=
1:GOSUB 310:RR=0:E$(X-SS,Y-DD)="
":X=X-SS:Y=Y-DD
1130 MID$(X$,INSTR(X$," "),1)=MI
D$(WD$,LEN(WD$),1):WD$=LEFT$(WD$
,LEN(WD$)-1)
1140 RETURN
1150 D=0:T=0:TS=0:CS=0:S=0:IF P=
1 THEN P1$=X$ ELSE P2$=X$
1160 L$=E$(X1,Y1):FW$=FW$+L$:IF
X1=X AND Y1=Y THEN 1230
1170 M$=MID$(D$(Y1),X1,1):IF M$=
"R" THEN T=T+1 ELSE IF M$="P" TH
EN D=D+1
1180 IF L$="*" THEN L$="A"
1190 L=ASC(L$)-64:L=V(L):IF M$="
L" THEN L=L*2 ELSE IF M$="B" THE
N L=L*3
1200 CS=CS+L
1210 X1=X1+SS:Y1=Y1+DD
1220 GOTO 1160
1230 IF D>0 THEN FOR A=1 TO D:CS
=CS*2:NEXT
1240 IF T>0 THEN FOR A=1 TO T:CS
=CS*3:NEXT
1250 IF X$="        " THEN CS=CS+
75
1260 IF P=1  THEN S1=S1+CS ELSE
S2=S2+CS
1270 GOSUB 680
1280 GOSUB 890:PRINT@480,"
        ";:IF P=1 THEN P=2:RETU
RN ELSE P=1:RETURN
1290 GOSUB 880:IF P=1 THEN X$=P1
$ ELSE X$=P2$
1300 C=271:FOR X=1 TO 7:IF X=5 T
HEN Q=X:GOSUB 880:X=Q:C=271
1310 L$=MID$(X$,X,1)
1320 L$="CHANGE "+L$+"?":PRINT@C
,L$:C=C+32
1330 EXEC 44539:A$=INKEY$:IF A$=
"N" THEN NEXT X:GOTO 1350: ELSE
IF A$="Y" THEN GOTO 1340 ELSE 13
30
1340 MID$(LL$,INSTR(LL$," "),1)=
MID$(X$,X,1):MID$(X$,X,1)=" ":NE
XT X
1350 IF P=1 THEN P1$=X$ ELSE P2$
=X$
1360 GOSUB 680
1370 IF P=1 THEN P=2 ELSE P=1
1380 RETURN
1390 SAVEM"SAVEGAME",1024,1535,1
024
1400 OPEN"O",#1,"SAVEGAME":FOR I
=1 TO 15:FOR A=1 TO 15:WRITE #1,
E$(I,A):NEXT A,I:WRITE #1,LL$,P1
$,P2$,S1,S2,P
1410 CLOSE
1420 PLAY"T5L5A"
1430 RETURN
1440 LOADM "SAVEGAME":OPEN"I",#1
,"SAVEGAME":FOR I=1 TO 15:FOR A=
1 TO 15:INPUT #1,E$(I,A):NEXT A,
I:INPUT #1,LL$,P1$,P2$,S1,S2,P:C
LOSE:PLAY"T5L5A":RETURN
1450 CLS:PRINT:PRINT:PRINT:PRINT
" PRESS ANY KEY TO STOP TIMER.."
:FOR I=1 TO 500:PRINT@164,"
   >       <":PRINT@173,I;:A$=INK
EY$:IF A$<>"" THEN RETURN ELSE C
=RND(I):V=RND(I/4):NEXTI:GOTO 14
50
1460 CLS:IF S1>S2 THEN P$="PLAYE
R 1" ELSE P$="PLAYER 2"
1470 IF S1>S2 THEN S=S1 ELSE S=S
2
1480 V$="":V$=P$:V1$=" WINS WITH
 A SCORE OF"+STR$(S)
1490 PRINT"              "V$
1500 PRINT@484,V1$;
1510 GOTO 1510
1520 IF RO=1 THEN 1590
1530 IF INSTR(WD$,CHR$(255))>0 T
HEN 1590
1540 FOR A=X1-1 TO X1+1:FOR B=Y1
-1 TO Y1+1
1550 IF A<1 THEN A=1 ELSE IF A>1
5 THEN A=15
1560 IF B<1 THEN B=1 ELSE IF B>1
5 THEN B=15
1570 IF SS=1 THEN IF E$(A,B) <>"
" AND (B<>Y OR (A<X1 OR A>X) ) T
HEN 1590 ELSE NEXT B,A:GOTO 1600
1580 IF E$(A,B) <>"" AND (A<>X O
R (B<Y1 OR B>Y) ) THEN 1590 ELSE
 NEXT B,A:GOTO 1600
1590 GG=1:RETURN
1600 GG=0:RETURN
1610 WD$=WD$+CHR$(255):X=X+SS:Y=
Y+DD
1620 IF X>14 OR Y>14 THEN RETURN
1630 IF E$(X,Y)<>"" THEN 1610 EL
SE RETURN
```

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The A-Option Wrap-Up

by Joseph Kolar
Contributing Editor

This is the wrap-up chapter of the A-option phase. You have been subjected to an awful lot of "mask this, unmask that." As usual, there is a method to all this madness. REM is a very desirable tool to have at your command when programming. REM allows you to temporarily put program lines or portions of program lines into mothballs to aid you in checking alternate lines and variants. It also allows you to skip around to other segments of a routine or hop to some other program section.

The operative word is *alternate*. For the keen-minded reader, an alternate menu is masked with a REM. During a programming session you mask and unmask lines to conduct tests on part of a program, or you reach for options. When the program is complete, the REMs become options in a menu.

In this tutorial we are going to work REM to death. Keep in mind while you are working that you are programming by proxy.

Refer to Listing 1. You may have rewritten the core of the program from a previous tutorial so that the program lines run in a logical sequence, with the design displayed and then removed. Room was made available to list Line 5, the routine beginning at Line 500, and lines 620 and 621. These designs were covered in the last tutorial. Type them into your final listing to check them. Base your routines beginning at Line 500 on the routines beginning at Line 600 in Listing 1 of this tutorial.

A new technique is introduced to add variety in displaying Swazicross on the screen. Type in lines 6 through 280 and run the program. Swazicross is displayed like a slow-motion flower growing and unfolding. Actually, the design units are drawn one at a time, running in a counterclockwise direction and advancing to the next higher step size until all sizes are displayed in all four quadrants. Lines 105, 107 and 130 complete this nested loop.

To dissolve this design, lines 222, 223 and 260 make a loop that cause it to shrink into infinity. It shrinks so rapidly that whether or not it withers away in a clockwise or counterclockwise direction is not important. The alternate method is to unmask Line 132. This holds the display longer but wipes it out instantaneously. It is a programming aid only. Who wants to see a design come and go like a yo-yo when he is busy working on it? Once the design is finished, it is more elegant to magically reduce the design into oblivion.

Rather than discuss all the normal options to draw or erase a graphic, we will place the hot scoop into a loop table.

Together means all four A options are placed in a given size on the screen. *Individual* means an A option is put on the screen in all sizes in one quadrant before we go to the next A option. *CCW* and *CW* stand for counterclockwise and clockwise, respectively. *In* means a design evolves from the outside toward the center. *Out* means the design begins at the center of the screen and increases outwardly. *A up* means stepping the design in a clockwise direction and *A down* means step it in a counterclockwise direction. *S up* means increase the size by steps while *S down* means decrease the size.

Some A option lines may have to be retyped rather than make extra REM lines, which may only serve to confuse you. REM is more useful because the masked line is alive but dormant. It is so easy to forget the contents of a previously altered or erased line when you want to restore the original lines.

By no means have we exhausted the possibilities. I am not eager to make a complete table and deprive you of the excitement of discovering the many possibilities and demonstrating them on the screen. Choose the ones that tickle your fancy and make saves of examples of those forms. Remember, you can always strip away the excess baggage and use the core of the listing, lines 9 through 280, for demonstration purposes. You may want to list your favorites in a notebook for handy reference.

You can experiment and draw the design from the largest element to the smallest. You should wind up with eight ways to draw the design (see Table 1): together or individual, in or out, clockwise or counterclockwise. Naturally, the same applies to erasing segments. You can see, by making your selections to draw or erase, you have the tools to create lots of variety in your presentations. And don't forget the instantaneous wipe-outs!

There are other possibilities as well. Some we mentioned in passing, and others you will stumble upon as you continue to investigate and experiment.

If you get an NF Error in lines 260 and 261, the loops are reversed. Switch to the other line with NEXT. Take plenty of time. Manipulate the REMs that create the FOR/NEXT loops and you will be amply rewarded.

Type in lines 6 and 600 to the end of the listing. Let us examine various designs. Unmask lines 6, 600 and 622. Mask Line 100 and run the program. We get the A0 design with cross-hairs. Run it with Line 632 masked. The rest of the design units are drawn and erased. The cross hairs fall away and the finished design is displayed on the two random screens.

The first A0 portrayal is a naked design

Florida-based Joseph Kolar is a veteran writer and programmer who specializes in introducing beginners to the power of the CoCo.

unit in STEP-4 size. The entire design is drawn in STEP-2 to add more detail. Unmask lines 632 and 623 and run the program. Mask Line 632 and run it again. Each design element looks like a crystal. Are you using your graph paper? Suppose we remove the final M-2,-1 in Line 623 — it ruins our crystal effect. Unmask Line 632 and run the program. In Line 623, substitute other values in the first M direction. In other words, M+3,+1; M+2,+1; M+4,-3. Watch where the design points. If you used M+2,+2, what does your graph paper plot tell you?

No matter what alterations are made, interesting effects are created. If you feel adventurous, make B jump moves out of the M directions you are playing with. Then try substituting N for the B. Personally, I like using NM+4,-3.

Using directions other than the regular E, F, G and H directions tilts the design to the right. Can we tilt it to the left? You may have already done so. The advantages of M motion directions is that, while H confines us to one absolute direction in the fourth quadrant, M allows us to make more subtle angles, depending on the length of the line drawn (L). The length of the line plus the length of the line minus two (D=L+L-2) equals the number of other directions allowed by the CoCo in that quadrant. Therefore instead of only an H5 direction in the fourth quadrant, you have eight other directions as well.

Unmask Line 623. Type in Line 620 so that in succession you have A$="M-5,-1" through "M-5,-4"; then "H5", (M-5,-5); then "M-4,-5" through "M-1,-5". Now run each one separately.

We might as well as have some fun. Let's put all these directions in the proper order to see what comes up. Retype the following line:

```
620 A$="M-5,-1M-5,-2M-5,-3M-5,-4
H5M-4,-5M-3,-5M-2,-5M-1,-5"
```

Then run the program. Oops! In Line 630 change BM128,96 to BM255,191. Change X=40 to X=20 in Line 629. Run the program again. We have drawn five very gently curving lines in sizes 4 to 20 in STEP+4.

If you plotted it out on graph paper, you knew ahead of time what the CoCo was going to do. Mask Line 632. Restore lines 629 and 630 to their original state, then run the program. (It looks like ostrich feathers.) You can alter the program so the design doesn't crash and then save a copy for posterity's sake.

Unmask Line 632 and Line 624, then run the program. Mask Line 632 and run. Have you noticed that interesting erase designs keep cropping up? Unmask lines 632 and 624 and run the program. Mask Line 632 and run the program again. Next check out the design in Line 625. The design in Line 626 is an optical illusion. CoCo is playing tricks on us. Next check out the designs in lines 627 and 628.

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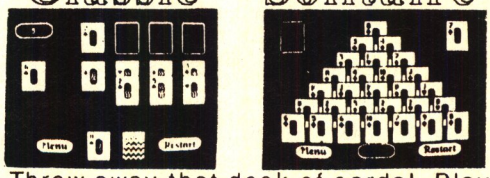

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ON	TOGETHER	CCW	OUT
	105 S up		
	107 A down		130
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	222 S down		
	223 A down		260
ON	TOGETHER	CW	OUT
	105 S up		
	107 A up		130
OFF	TOGETHER	CCW	OUT
	221 S up		
	223 A down		260
ON	INDIVIDUAL	CCW	OUT
	104 A down		
	105 S up		131
OFF	INDIVIDUAL	CW	OUT
	220 A up		
	221 S up		261
ON	INDIVIDUAL	CW	OUT
	104 A up		
	105 S up		131
OFF	INDIVIDUAL	CW	IN
	220 A up		
	222 S down		261

Table 1: Design Possibilities

Unmask lines 7, 700 and 720 and run the program. Mask Line 732 and run the program again. This rhomboid shape has unexplained dots in the second quadrant. You can cover up the dots by inserting NF3 at the beginning of Line 720. The alternate method is to add NH3 to the end of Line 720. Inserting NL3NF3 at the beginning of Line 720 produces a nice effect. Check out the designs in lines 721 and 722. Mask Line 732, unmask Line 723, and run the program. If you don't pay close attention, it is difficult to identify the design unit.

Leave Line 732 masked and unmask Line 724. Now run the program. This gives nice effects, both drawn and erased. Try this out by inserting BH2 at the beginning. It is difficult to guess what a design will look like after viewing the A0 unit. If you removed the N from Line 724, the design looks somewhat like a map of Texas.

Unmask Line 725 and run the program. This is a high-caliber design. Note how slowly it appears and disappears. The longer the program line, the longer it takes CoCo to execute it — a decided advantage in this case. It seems to pulsate. Insert BD3 at the start of Line 725. Outside of ruining a super design, watch how CoCo convolutes inward to a "That's all, folks" ending.

Unmask Line 726 and run the program. This is a fancy Vienna-waltz medal. Unmask Line 727 and run the program. A design need not be too big or complex to have merit. Short program lines, as in Line 727, are great to modify. You are invited to experiment with this design. Inserting L3 in the line causes a nice break-up display.

Unmask Line 728 and run the program. This is a replica of the perseverance medal you just won for struggling through this tutorial.

There is no reason why you can't draw two different designs to make a spectacular rendition. Choose well-balanced designs, one of which should be oriented along the U, D, L and R axes and the other in E, F, G and H orientation. Here is an example using very basic design elements:

```
100 A$="R3U2R3D4L3U2L3"
101 C$="E2U2R3ULD3L2G2"
```

These design elements were drawn so they end at the starting point. This is vital if you plan to push the designs outward from a point of origin.

To the ends of lines 120 and 250, tack on +C$. Add a temporary hold line:

```
140 GOTO 140
```

and run the program. See how massive the horizontal/vertical design is? It overshadows the puny diagonal design. The C$ design can be reworked or pushed out. Change E2 at the beginning of Line 101 to E4, then run the program. Let's push it out one more unit. Change E4 to E5 in Line 101. Then run the program. The diagonals are on the verge of overwhelming the formerly massive-looking cross. This is unbelievable! Repeat these last three experiments, E2, E4 and E5. See how unrelated the displays appear? Incredible! The height of the vertical element is 11 centimeters, in each case, on my monitor. In the first instance it is very massive, and in the last instance it becomes a secondary design.

Check the graph paper plot of these designs to see how increasing the first element in a symmetrical element pushes the design outward. To see this in reverse, change the first R3 to R and the final L3 to L in Line 100. In Line 101 change E5 to E3, then run the program. Not bad, but E4 may look better to you than E3. Try it! If you want to see the diagonal design nearly disappear yet give strength to the cross, insert N in front of E3. Type in DEL140 and run the program. This last demo has an intriguing erase show.

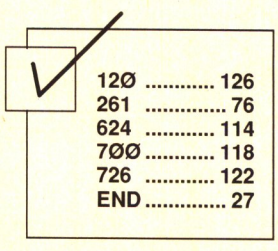
I hope you had fun making these shapes. There are a lot of loose ends for you to tie together. Make up your own shapes. Review these last four A-option tutorials and use up the graph paper. Allow me to end this tutorial with the flag of Moldavia from Dynastyland.

At the beginning of lines 629 and 729, insert GOTO100. The colon was left out at the end because the REM marker effectively hides the second statement. Add Line 140 GOTO 700. Mask lines 100, 101, 610, 632, 700 and 710. Unmask lines 6, 600, 622 and 728. Then run the program. To make this flag draw and erase both designs at the same time:

Change A$ to C$ in Line 728.
Change 100 to 9 in Line 729.
Type DEL600:DEL629:DEL140.

Finally, like a good programmer, strip off unessential lines and put the program into a logical, straightforward format. The listing is shortened significantly. If you want to try and tighten up your program, do so now and compare it with Listing 2. ❑

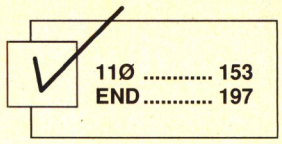
16K Extended



Listing 1: AOPTION1

```
0 'LISTING1
6 'GOTO600'ON THE BIAS
7 'GOTO700
9 T=RND(2): ON T GOTO10,11
```

```
10 PMODE4,1:PCLS:SCREEN1,0:GOTO1
00
11 PMODE4,1:PCLS:SCREEN1,1
100 A$="BH2U3R3G3L3U3E3"
104 'FOR A=3 TO 0 STEP-1
105 FOR S=4 TO 40 STEP2
106 'FOR S=40 TO 4 STEP-2
107 FOR A=3 TO 0 STEP-1
110 B$="S"+STR$(S)
115 D$="A"+STR$(A)
120 DRAW "BM128,96"+D$+B$+A$
130 NEXT A,S
131 'NEXT S,A
132 'FOR Z=1TO 2000:NEXT:GOTO280
200 FOR Z=1 TO 600:NEXT
220 'FOR A=0 TO 3
221 'FOR S=4 TO 40 STEP2
222 FOR S=40 TO 4 STEP-2
223 FOR A=3 TO 0 STEP-1
240 B$="S"+STR$(S):D$="A"+STR$(A
)
250 DRAW"C4BM128,96"+D$+B$+A$
260 NEXT A,S
261 'NEXT S,A
270 'FOR Z= 1 TO 2000: NEXT:PCLS
:GOTO 9
280 FOR Z=1 TO 200:NEXT:PCLS:GOT
09
600 'PMODE4,1:PCLS:SCREEN1,1
610 DRAW"BM0,96R128NR128NU96D96"
620 '
621 '
622 'A$="BE4U2R3ULD3L2BG4"
623 'A$="M+3,-2U2R3M-1,3M-2,-1"
624 'A$="M+3,-2M-1,-2R4M-1,3M-2,
-2M-3,2"
625 'A$="M+3,-2U3R7U2L2D5L5M-3,2
"
626 'A$="BM+6,-4H2M+4,-1F2M-2,3H
2BM-6,4"'OPT. ILL.
627 'A$="U2R6U2NM+3,-2L3D4L3"
628 'A$="U4R3D2M+3,-2NLNDM-3,2R3
D2L6"
629 FOR X=40 TO 4 STEP-4
630 DRAW"S=X;BM128,96"+A$
631 NEXT X:FORZ=1TO2000:NEXT
632 GOTO632
633 GOTO 100
700 'PMODE4,1:PCLS:SCREEN1,1
710 LINE(0,96)-(255,96),PSET:LIN
E-(128,191),PRESET:LINE-(128,0),
PSET
720 'A$="M+1,-2M+2,-1M-1,2M-2,1"
721 'A$="M+3,-2U3M+3,-1D2M+3,-2M
-3,2R2G2L3M-3,2"
722 'A$="BM+3,-2U2R6U2L3D4L3"
723 'A$="M+1,-5FD2NG2R2FM-5,1"
724 'A$="M+1,-3NF2ER2D2GM-3,1"
725 'A$="EFGHREFGHRE2F2G2H2UEFGH
DEFGHDEFGH"
726 'A$="RNENFRNHNGRNENFR"
727 'A$="UNLREFGH"
728 'A$="BL4EGFHRHFGERGEHFRFHEGE
FGH"
729 FOR X=4 TO 40 STEP 4
730 DRAW"S=X;BM128,96"+A$
731 NEXT X:FORZ=1TO2000:NEXT
732 GOTO732
733 GOTO100
999 GOTO 999
```



Listing 2: AOPTION2

```
0 'LISTING2
9 T=RND(2): ON T GOTO10,11
10 PMODE4,1:PCLS:SCREEN1,0:GOTO1
00
11 PMODE4,1:PCLS:SCREEN1,1
100 A$="BE4U2R3ULD3L2BG4"
101 C$="BL4EGFHRHFGERFEHFRFHEGEF
GH"
105 FOR S=4 TO 40 STEP2
107 FOR A=3 TO 0 STEP-1
110 B$="S"+STR$(S)
115 D$="A"+STR$(A)
120 DRAW "BM128,96"+D$+B$+A$+C$
130 NEXT A,S
200 FOR Z=1 TO 600:NEXT
222 FOR S=40 TO 4 STEP-2
223 FOR A=3 TO 0 STEP-1
240 B$="S"+STR$(S):D$="A"+STR$(A
)
250 DRAW"C4BM128,96"+D$+B$+A$+C$
260 NEXT A,S
280 FOR Z=1 TO 200:NEXT:PCLS:GOT
09
```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Breaking the 32K Barrier

by Greg L. Zumwalt

How all that information fits into one little ROM pack

It seems like just yesterday when I bought my first Color Computer. I remember putting it out on the living room floor, with a handful of Program Paks, and spending the better part of the evening trying my hand at skiing, chess, battling dinosaurs and fighting aliens from another world.

Since those days, the Program Pak has grown from 4K to 16K. The programs have grown in complexity and graphic detail. With the introduction of the Color Computer 3, the 32K Program Pak was introduced and the sophistication of the newer games grew even more.

However, the video games for the video-game-only systems quickly outpaced the complexity of the games for the Color Computer family. These games took hours, days and sometimes even weeks to play. As a developer, my instincts convinced me to dismantle one of the less popular game packs in our household (at the risk of becoming permanently disowned by the younger members of the family) to see how such a complex game could fit inside. As I expected, the game used two large ROM chips, for a total storage capacity in the range of one million bits. At best, the 32K capacity of the Color Computer 3 Program Pak is only one-fourth of this capacity (1,048,576/262,144).

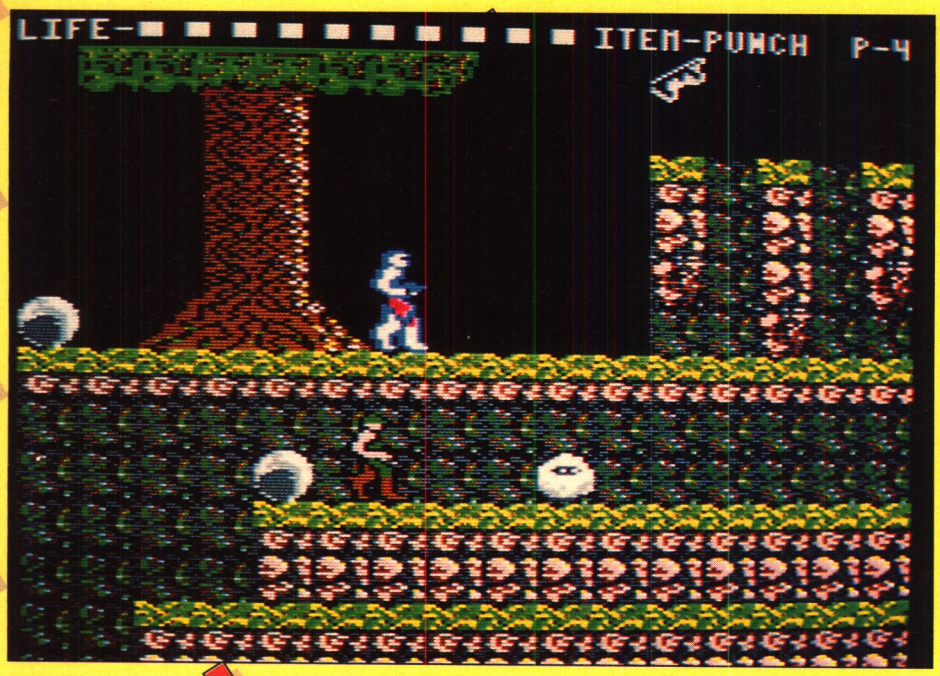
Some of the questions I was posed with are: Can the mega-bit programs found in these games fit into a Program Pak's architecture? What sacrifices would be made? How much would it cost?

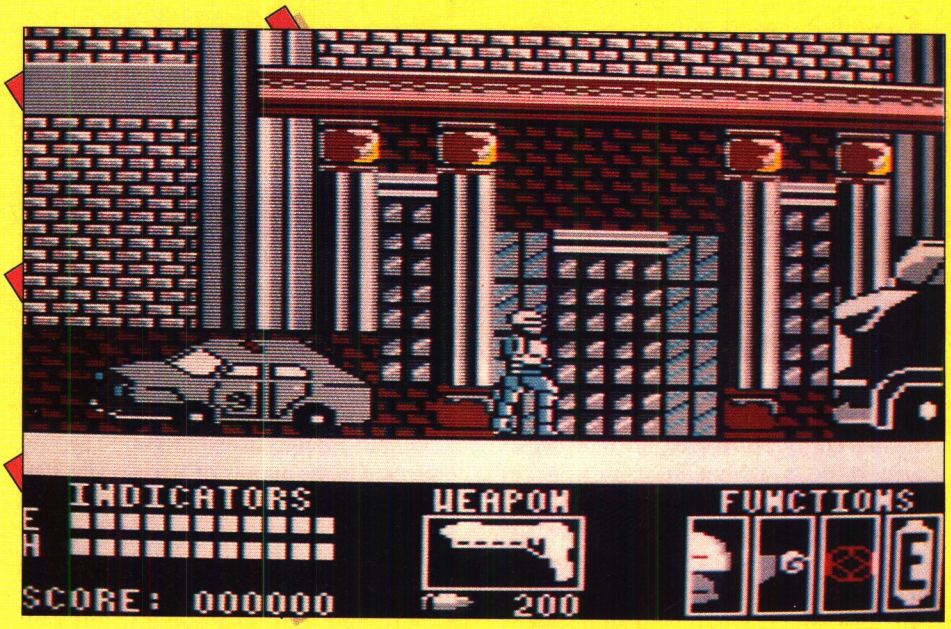
Hardware/Software Considerations

The first, and perhaps most obvious, solution was to redesign the Color Computer so the increased capacity is built into the computer, and not the Program Pak. Logically, putting a gate array for address

---

An independent programmer and computer designer, Greg Zumwalt owns ZCT Software of Tulsa, Oklahoma. ZCT is the developer of the Predator *and* RoboCop ROM *Paks.*





decoding and mega-bit ROMs in the Program Pak increases the price to prohibitively high levels. This approach would require all of us who wanted the newer Program Pak games to buy new computers, increasing the total expense even more. Not a good solution.

What about smaller ROMs and a less expensive approach to decoding the increased capacity? This idea is a little better, but by itself this solution requires that the games still be less complex than counterparts because of the smaller amount of available storage.

What about a combination of smaller ROMs, less expensive decoding and software? Perhaps this is the best solution.

Developing the Hardware

The first step in developing the hardware design is to determine how the larger ROM is to be addressed. My first choice is to treat the ROM as 32K pages of memory and design the hardware accordingly. The technique of paging is somewhat like the Color Computer 3 memory management unit (MMU), although a lot simpler. Under program control, the Color Computer 3 is placed in the 32K external ROM mode. Then, using a miniature version of an MMU, the program can select which of the two 32K pages of, for example, a 64K ROM, appears in the external ROM address space. However, this immediately limits the increased ROM capacity to the Color Computer 3, leaving the Color Computer 1 and 2 by the wayside. I decided this was an unacceptable approach and treated the ROM as 16K pages, allowing the use of the 16K internal and 16K external ROM mode that is compatible with the entire Color Computer family.

The second step involves designing the miniature MMU that provides access to the various 16K pages. The miniature MMU is a simple latch, but it has to be located in an area of memory that always remains mapped in the 64K address range of the 6809 microprocessor. Thus it is not affected by the memory mode (all RAM, 16K internal/16K external) or paging process. The solution, built into the Color Computer, is a strobe

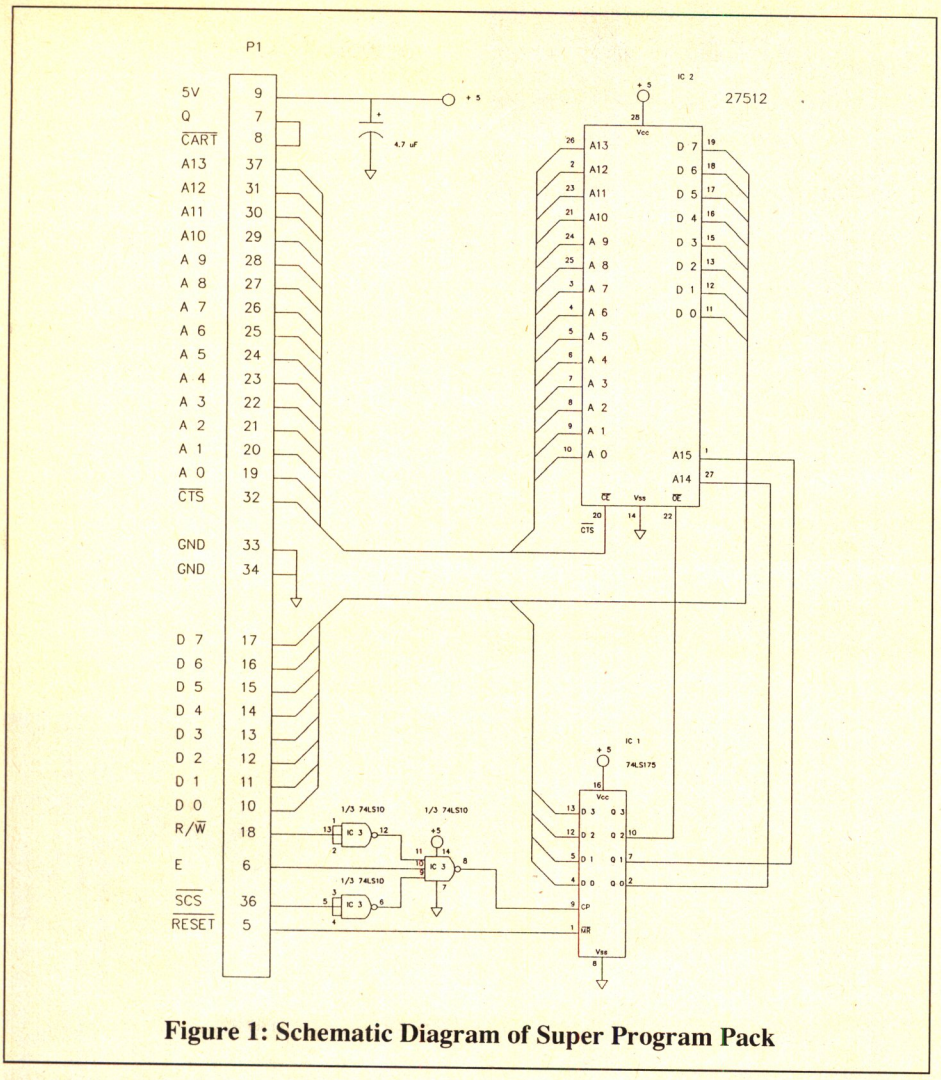


Figure 1: Schematic Diagram of Super Program Pack

labeled *SCS, or Secondary Chip Select. (The first chip select is the Cartridge Select strobe, or *CTS, for the ROM itself as described in the Color Computer 3 service manual.) This strobe is active for both reads and writes to addresses $FF40 through $FF5F, regardless of the memory mode. Using this strobe and the miniature MMU, the program simply writes a page number in order to gain access to the various pages.

Hardware Breakdown

Figure 1 is a schematic diagram of the 64K-by-8 bit EPROM version of the Super Program Pak. As can be seen from this diagram, only three ICs are required.

IC2 is the 64K-by-8 bit EPROM. This IC contains a game or other program, the data for the game or program and a program to access the various ROM pages. Address pins A0 through A13 of this IC are connected directly to the edge-card connector P1, as would be a standard 16K ROM. The Chip-Enable strobe at Pin 20 is connected to the Cartridge-Select strobe provided by the Color Computer at Pin 32 of P1. The eight data pins D0 through D7 are also connected directly to the edge-card connector P1. Address pins A14 and A15 and the Output-Enable strobe at Pin 22 are all connected to the ouputs of IC1, a 74LS175 that serves as our miniature MMU.

IC1 is a quad latch with a strobe input (Pin 9), a Master-Reset input (Pin 1), four data inputs, D0 through D3 (pins 4, 5, 12 and 13), and four data outputs, three of which, Q0 through Q2, are used in the Super Program Pak (pins 2, 7 and 10). When the Master-Reset pin is held Low (Logic 0), the output latches are asynchronously reset Low. With the Master-Reset pin High (Logic 1), data present at the input to the latch (D0 through D3) is latched and presented at the output pins, Q0 through Q3, when the clock input (CP at Pin 9) makes a transition from Low to High. The clock input is generated by IC3, a 74LS10.

IC3 is a triple, three-input NAND gate. This IC, along with the Read/*Write, E and *SCS signals generated by the Color Computer at pins 18, 6 and 36 of connector P1 determine the proper time to latch data into IC1. If you are familiar with the 6809 microprocessor, the 74LS10 NAND gate and the design of the Color Computer, you can see that the output of IC3 (Pin 8) goes low at the beginning of the leading edge of the E clock during a write cycle and when the *SCS strobe is Low. At the end of the write cycle, this output changes from Low to High, allowing the data at the input pins of IC1 to latch together.

Now that each of the ICs have been identified, let's see how they all work together to form the Super Program Pak. When the Color Computer is first turned on (or if the Reset button is pressed), the Reset signal (Pin 5 on connector P1) goes Low. This causes IC1, the quad latch, to force its outputs D0 through D3 Low. Therefore, the Output Enable, A14 and A15 inputs of IC2 (the EPROM) are also Low. At this point, the first (or lowest) 16K page of the 64K EPROM may be read, starting at Address $C000 through the remaining address inputs A0 through A13, assuming the Color Computer is in the external ROM mode.

After a reset, BASIC performs an initialization sequence to determine if a cartridge is installed in the cartridge slot. This is accomplished via an interrupt generated through the *CART signal at P1 Pin 8. When this occurs, BASIC, already initialized in the 16K internal/16K external ROM mode, simply jumps to Address $C000. However, Color Computer 3 BASIC copies itself into RAM during initialization and changes the configuration of the Color Computer to the all-RAM mode. Therefore, when the *CART interrupt is detected, it must reconfigure the Color Computer 3 for the 16K internal/16K external ROM mode and jump to the routine at Address $C000.

In either case, from this point on the program in IC2 must control the operation of the Super Program Pak. Initially, the program copies itself into a safe, or *non-paged*, area of the Color Computer's RAM and jumps to the copy in RAM.

Once in RAM, the program is free to select any of the four 16K pages (pages 1-4) of IC2 via a write to Address $FF40. For example, to select Page 2, the second 16K page, use the following lines of assembly language code:

```
lda   #$01
sta   $FF40
```

To select Page 4, the fourth 16K page, use the following lines of code:

```
lda   #$03
sta   $FF40
```

Software Techniques

We have now doubled the Program Pak capacity from 32K to 64K bytes, yet we still haven't attained the mega-bit capacity found in some of the other game cartridges. The next step is to increase the efficiency of

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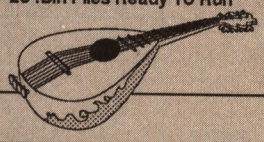

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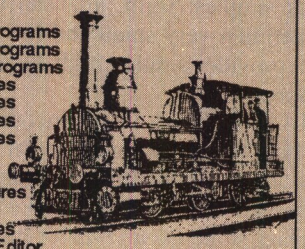

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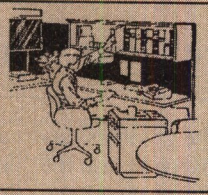

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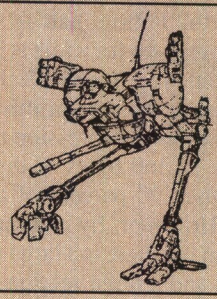
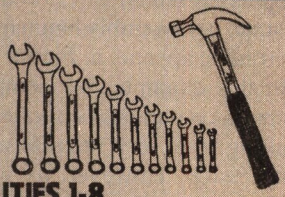
GA8 - Football, Leaky Tap, Poker, SubHunt, +
GA9 - Battle, Chick, Flight, Prix, +
GA10 - Blockade, Fly, Missile2, Pong, +
GA11 - Bunker3, Guadal, Martians, Traders, +





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how we use the ROM so that it appears as if mega-bit capacity is available.

Several applications use data compression to reduce data storage requirements and/or transmission time. Data compression attempts to reduce the size of a block of data so it can be stored in less space or transmitted in less time. Once stored or transmitted, a decompression routine is used to restore the compressed data to its original state.

Data compression techniques vary in speed, complexity, size and efficiency. Indeed, some compression programs implement a number of compression techniques on a program or data file, then select the technique resulting in the greatest compression. One of these techniques, known as *run-length encoding* (RLE), is a common technique for compressing data. In its simplest form, RLE can be implemented in a very small and fast program, yet it provides a rather high degree of data compression.

To explain run-length encoding and to see how it compresses data, let's assume we want to save a Color Computer 3 graphics screen on disk. Let's also assume the graphics screen is a 16-color display, 160 pixels (80 bytes) wide, and 192 lines tall. And for simplicitiy, our final assumptions are that the top half of the screen is solid white, the bottom half is solid black, the palette register for white is Register 01, and the palette register for black is Register 00.

To save a screen of this size directly to disk without compression requires 160/2 * 192 or 15,360 bytes of disk space (that's more than 90 percent of a 16K Program Pak). However, by examining the screen you can see there is a large section of white on top and a large section of black on the bottom. Instead of saving each of these large sections byte-by-byte, you can count the number of white pixels, save the count and color as a code, then count the number of black pixels and again save the count and color as a code. Using this technique requires only six bytes to represent the entire screen. For example, the top half, or white section of the screen, is 80 bytes wide and 96 bytes tall. Thus if we save the color code for white (01 in our example) as a single byte, followed by a two-byte representation of the byte count (80 * 96 = 7680), we can reduce the storage requirement from 7680 bytes to three bytes. The same process is repeated for the bottom half, or black section of the screen. Therefore, the entire screen is reduced from the original 15,360 bytes to six bytes, or 1/2560th of its original storage requirement.

A routine to perform the compression executes the following steps: First, the routine sets a pointer to the address of the upper left-hand corner of the graphics display. Next, the routine reads the byte at the pointer, bumps the pointer to the next byte, then initializes a counter to 1 (indicating one byte of this color has been determined). A loop then enters to compare the next byte. If the byte is the same, the counter is incremented by one, and a test is performed to ensure the routine has not exceeded the screen limits. If the byte differs, the current color and count are saved to disk, followed by another check on the screen limits. If the end of the screen has not been reached, the routine continues with the new color byte. An assembly language example of the compression routine appears as shown in Figure 2.

```
            lda     scrnaddr  get screen address in Register X
loop1       lda     ,x+       get the color byte
            ldy     #1        initialize ocunt
loop2       cmpa    ,x+       next byte match?
            bne     loop3     no
            leay    1,y       yes, count is now + 1
            cmpx    scrnend   have we hit the end of the screen?
            bne     loop2     no
loop3       lbsr    writecol  write A, the color byte
            lbsr    wrutecbt  write Y, the count bytes
            cmpx    scrnend   did we hit the end of the screen?
            blo     loop1     no, continue
endloop     equ     *
```

Figure 2: Sample Compression Routine #1

```
            ldx     scrnaddr  get screen address in Register X
loop1       lbsr    readcol   read color byte into Register A
            bcs     endloop   readcol detected end of file, end
            lbsr    readcnt   else, read bytecount into Register Y
loop2       sta     ,x+       write color, update pointer
            leay    -1,y      continue until byte count is zero
            bne     loop2
            bra     loop1     then get the next color
endloop     equ     *
```

Figure 3: Sample Compression Routine #2

A decompression program is now required to restore the compressed screen file to its original state. First the decompression routine sets a pointer to the address of the upper-left hand corner of the graphics display. Next it reads the first byte of the compressed screen from the disk, this being white in our example, followed by the next two bytes, the byte counter. A loop then enters to store the color byte at the current pointer address, increments the pointer address, decrements the byte counter and continues until it reaches zero. When all the color bytes are stored, the next color byte and byte counter are read from the disk and the process continues. If you reach the end of the disk file, the process ends and the compressed screen is restored to its original state. An assembly language version of this routine appears in Figure 3.

In this example, the compression/decompression routines performed quite well, resulting in a very impressive degree of compression. However, as we will see, these simple routines can actually produce a compressed file larger than the original file.

Let's change our assumption a little by saying that the screen consists entirely of alternating white and black pixels (the first pixel is white, the second is black, the third is white, etc.) The compression routine starts at the top left-hand corner of the screen and finds a white pixel. It then initializes the byte counter to 1 and starts counting the subsequent white pixels. However, at the very next byte it finds the color black, so it saves the white color pixel and the counter (containing a count of 1) to the disk, then starts compressing black pixels. Again, at the very next byte, it finds a different color (white), so it writes the black color pixel and the counter (again containing a count of 1) to the disk, then starts compressing white pixels. But on the

very next byte — well, you get the picture. The final result is that for each byte on the screen the compression routine saves three compressed bytes, one for the color code and two for the count. Thus we require three times (or 46,080 bytes) the amount of storage on the disk as is required if you simply save it byte-by-byte. Fortunately, we can do better.

A Better Decompression Technique

Just as there are various techniques for compressing data, there are various techniques for run-length encoding and decoding. The techniques described here involve distinguishing between single-byte runs of data (the type that caused the problem in the earlier design), and multi-byte runs (multiple bytes of the same type) of data. It accomplishes this by establishing a coded run type, which informs the decompression program that either a single byte or a run of bytes has occurred. (Although normally quite efficient, this simple technique can produce inefficient results under certain conditions, See if you can determine the conditions, or better yet, how to avoid them.)

The coded-run byte contains an arbitrary two-bit code in an arbitrary position within the byte. For our discussion, let's assume the arbitrary two-bit code resides in the upper two bits of the coded-run byte. The remaining six bits in the coded-run byte have different meanings.

Now let's assign definitions to the bit patterns of the two-bit code in the coded run byte. These two bits are defined in Table 1.

Note that if the upper two bits, bits 6 and 7, are set to 1, this indicates a multi-byte run. In this case the lower six bits of the coded-run byte contain a count, from 0 to 63, of the number of bytes to be duplicated. In the case of a multi-byte run, the byte immediately following the coded-run byte will be the byte to duplicate (the color byte in the earlier example).

If the upper two bytes contain any of the remaining three patterns, then the byte is a single-byte run and is a copy of the single byte found during the compression process. In other words, a byte not containing the bit pattern 11 in the upper two bits of the byte is simply copied to its destination.

Using this technique let's decompress the following run length encoded data:

$C3,$00,$AA,$C5,$55,$C0

The first byte, $C3, contains the bit pattern 11 in the upper two bits, indicating a multi-byte run. The lower six bits contain the bit pattern 000011 that represents the count, in this case three. The byte immediately following is the byte to duplicate, $00. Therefore, the first three bytes in our decompression process are:

Bytes:	1	2	3
Data:	$00	$00	$00

Skipping over the first coded run byte and the duplicate byte, the next byte, $AA, does not contain the multi-byte run code in the upper two bits. Therefore it is a single byte and is simply added to the decompressed list, which now appears as follows:

Bytes:	1	2	3	4
Data:	$00	$00	$00	$AA

The next byte, $C5, represents a multi-byte run, but this time it indicates five occurrences of the duplicate byte $55. What we now have is shown in Table 2.

Now we come to the final byte, $C0, which is a special case of the multi-byte run. In this case the count is 0, which indicates the end of the compressed data and therefore the end of decompression.

Analyzing the results of our simple example, the six bytes of compressed data were decompressed into eight bytes of data.

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Although that doesn't seem like much, the resulting compression saved two bytes, or 25 percent of storage. When applied to the Super Program Pak, 25 percent of 64K bytes is 16,384 bytes, or one-fourth of the uncompressed capacity of the ROM.

Now let's write some code that performs the decompression process. The assembly language code shown in Figure 4 decompresses data that has been compressed in the format we have just discussed. As you can see, the decompression subroutine is quite small, which, when used in a Program Pak environment, is exactly what we need. This small program, along with the compressed data, can and does save literally thousands of bytes of storage. In a Program Pak environment, this extra storage results in larger, more complex games and high-quality digitized graphics images.

A compression program is substantially larger in size. However, that does not concern us since the compression process happens outside of the Program Pak environment, under OS-9, for example. It does not have to be small or even fast. The program can be written in BASIC, C or some other higher-level language.

Bits								Definition
7	6	5	4	3	2	1	0	
0	0	X	X	X	X	X	X	not a multi-byte run
0	1	X	X	X	X	X	X	not a multi-byte run
1	0	X	X	X	X	X	X	not a multi-byte run
1	1	X	X	X	X	X	X	multi-byte run

Table 1: Bit-Pattern Definitions

Bytes:	0	1	2	3	4	5	6	7	8
Data:	$00	$00	$00	$AA	$55	$55	$55	$55	$55

Table 2: A Multi-Byte Run

```
*
* decomp
* decompress run length encoded data
* entry : register X points to start of compressed data
*       : register U points to destination
* exit  : registers restored
* calls : none
*decomp equ    *
   pshs d,x,y,u save registers for return
*
decomp1 lda    ,x      single or multi-byte run?
   anda #$C0
   cmpa #$C0
   beq  decomp3
*
decomp2 lda    ,x+     single, simply copy the byte
   sta  ,u+    and update the pointers
   bra  decomp1 then continue
*
decomp3 ldb    ,x+     multi, get count, update pointer
   andb #$3f
   beq  decomp9 end of compressed data if count = 0
   lda  ,x+    get duplicate byte, update pointer
decomp3a       sta    ,u+    duplicate register A,
   decb        register B times
   bne  decomp3a
   bra  decomp1 then continue
*
decomp9 puls   d,x,y,u,pc restore registers, return to caller
```

Figure 4: Decompression Routine

The Results

Does it work? You bet! The Super Program Pak made its debut with the release of two new Color Computer 3 products.

The first, developed by ZCT Systems Group for Activision, is *Predator*. It was with close cooperation between Activision, Tandy and ZCT Systems Group that *Predator* and the first Super Program Pak were developed. *Predator* features digitized bit-image graphics, full-screen horizontal scrolling in the Color Computer 3, 160-by-225 16-color graphics mode, sound effects and a whopping total of 53 stages and substages.

The second program developed by ZCT Systems Group for Data East is *RoboCop*. It features digitized bit-image graphics, full-screen horizontal scrolling in the Color Computer 3, 160-by-200 16-color graphics mode, sound effects and a total of 31 stages and substages. *RoboCop* also features highly-detailed background graphics. Over half of the 128K Super Program Pak is dedicated to the background graphics and sprites. Considering the average compression ratio for *RoboCop* data exceeded 6 to 1, over 384K bytes (3 mega-bits) of data is required for the game.

Where Do We Go From Here?

The Super Program Pak is designed to facilitate the use of either 64K by 8-bit or 128K by 8-bit ROMs. If you have the chance to see *Predator* or *RoboCop*, we are sure you'll agree that the complexity and graphic detail available in these games using the Super Program Pak and extensive data compression is right up there with the video-game-only counterparts.

However, the Super Program Pak II is now able to provide 512K-by-8 bit, 1024K-by-8 bit, and even greater ROM storage. By adding a sound processor, the possibilities are even greater since the newer Color Computer games using the Super Program Pak II should easily surpass the video-game-only counterparts.

Where we go from here depends on the interests of the Color Computer Community. ZCT Systems Group has been committed to serving the interests of the Color Computer Community through the development and production of Color Computer-based educational, personal productivity and entertainment programs. And thanks to the support of Tandy, Activision and Data East USA, that commitment continues with the release of *Predator*, *RoboCop* and the Super Program Pak series. If your response to this series is good, I'm certain you won't be disappointed with what's next.

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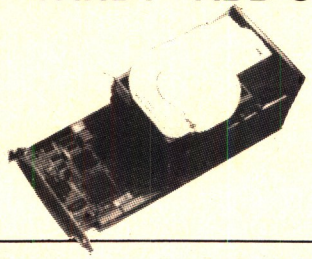

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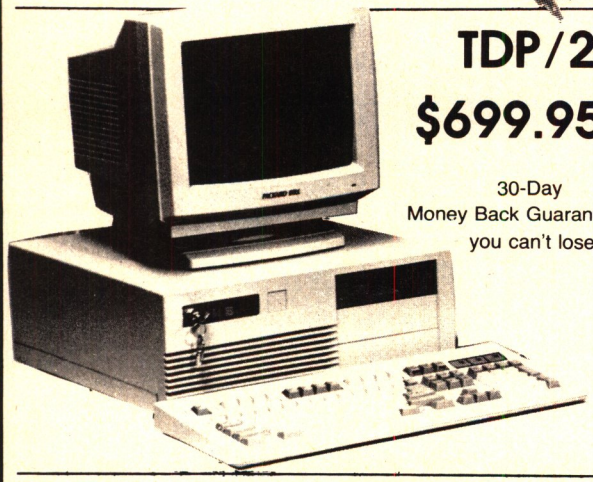

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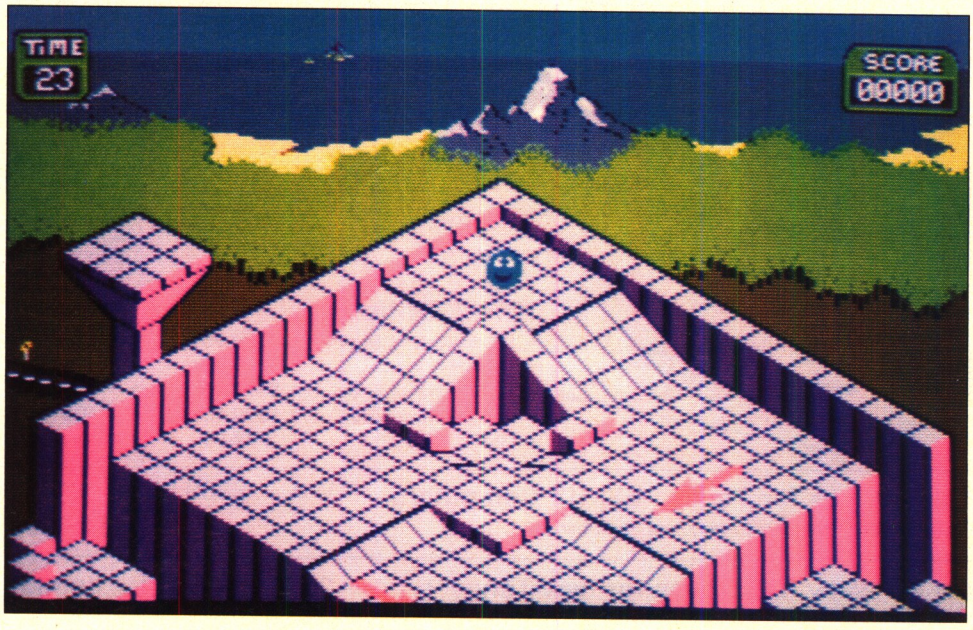

Software 512K CoCo 3

Those Darn Marbles— Enough to Make You Lose *Your* Marbles

I promised myself I would not sit down to write this review until I had cleared the second level of *Those Darn Marbles* and gotten a glimpse of the much-craved third level. I had to break that promise to myself, because I simply *cannot* clear the second level — and there are six levels in this game. I've sat in front of the computer until my seating apparatus becomes numb, and I've maneuvered my joystick until my fingers grow stiff and uncooperative. I've come heartbreakingly close, but no cigar.

What is this game that drives normally sane and sober people to madness, haunts their dreams at night and reduces a working day's productive output? It's *Those Darn Marbles* from Oblique Triad, an exciting 3-D, 512K game for Color Computer 3s, based on the arcade game *Marble Madness*. To play you'll need a 512K CoCo 3, a disk drive and a joystick. The game comes on four disks: a boot disk, a special effects disk and two level disks. The boot disk is copy-protected, but the rest are not.

Don't be put off by my inability to reach Level 3 — as arcade players go, I am an average Joe (Jane, actually). For you joystick jockeys, reaching Level 3 may be an exercise in effortlessness.

In *Those Darn Marbles*, the object of each level is to guide a marble down a maze of high ramps and passageways to a goal area marked END — in a given amount of time. The clock is always counting down. The END goal is flanked by waving flags, to give the appearance of entering a castle. Let me tell you, if you complete a level you feel worthy of a royal reception. Of course, I've only successfully completed one level.

Gravity and inertia are forces to be reckoned with in the universe of *Those Darn Marbles*. To move the marble, you press the joystick in the direction you want it to go. Nothing could be simpler, except . . . instead of the regular up/down/left/right joystick control, you move the stick in 45-degree increments to keep on an even keel. Pull the joystick straight up, down, left or right in your exuberance, and you are likely to go careening off the edge of your path into a very deep chasm.

Your marble does not like to fall, whether into chasms or off a dropoff to a lower level. It lets you know this: The marble has a face, you see. When it is happily rolling along, the marble wears a silly grin. When it falls off into space, it takes on a most pathetic panic-stricken expression. And

when it clunks off a dropoff its eyeballs roll around and it becomes generally disoriented (and when the marble becomes disoriented, you can't control it with the joystick). You can't run out of marbles; you can only run out of time. When the marble falls off the edge (or gets sucked up by "acid pools" — but we'll get to that later), you lose precious seconds.

Say you push the joystick to go left — the marble goes left. If you let off the joystick, the marble continues to roll for a little ways. So, unlike in the *Pac-Man* games, you can't stop on a dime and run in another direction. This takes some getting used to — this and the strange joystick orientation. It will take you probably more than an hour to become accustomed to joystick control. But the process is a lot of fun!

The area the marble rolls over consists of grid squares. Once I figured out that holding my joystick at the correct angle would let me travel aligned with the grid lines, my score improved. The grid lines and squares help you judge where you should be and where you're going.

Besides gravity, you and your marble need to be concerned about Marble Munchers, Jehosaphats and Acid Pools, which are "sentient bottomless pits that roam around, seeking to dissolve your marble into a pile of scrunge." In my experience so far with the game I have not encountered Marble Munchers or Jehosaphats, which the manual describes as being troublesome. But I have been dissolved countless times by the Acid Pools, and it's a time-consuming and unpleasant process.

There is a "magic wand" that sometimes appears and grants you 10 additional seconds in a round, but it is maddeningly random: In the more than 40 games I've played, I've seen the thing only three times. Also, the manual mentions hidden passageways and secret bridges, but I have yet to find any.

The author's sense of humor takes the game beyond being just an excellent arcade challenge. The marble itself — with that silly grin — is hilarious. There are other little humorous touches that add to the game. For instance, on the first level, there is graffiti on the wall stating "Elvis is buried here." (So pay no attention to those people who keep claiming to see him at Burger King.) On the high-score screen, if you mess up typing your name and press the backspace key, the game makes a cute boing-boing nose. It's the humorous little touches that make me really want to see what's beyond Level 2.

Speaking of boing-boing noises, the game is full of interesting sounds. As you would expect of a game requiring 512K, the graphics and sound effects are excellent. There is digitized speech and the graphics, about the best I've seen on any CoCo game, are colorful, clear and detailed. The animation and screen scroll are smooth.

The game screen deserves particular note because, according to Oblique Triad's advertisement, it is controlled by hardware — not by software. If this is a sample of what 512K can do on the CoCo, I really look forward to the release of more games to take advantage of this power.

I won't be satisfied until I see the third level. So after I save this file I guess it's back to the arcade for me. In case you haven't guessed, *Those Darn Marbles* is very addictive.

(Oblique Triad, 32 Church St., Georgetown, ON L7G 2A7, Canada, 416-877-8149; $32 U.S., $38 Cdn., plus $2.50 S/H)

—Carol Hartman

A Talk with the Programmer, Jeff Noyle

Q. *Why did you program* Those Darn Marbles *for 512K machines, and what do you think of the 512K market?*
A. There's a pretty healthy 512K market from my experience. Whether that's just people trying to justify their 512K machines is another matter. Hardware scrolling is the reason *Those Darn Marbles* requires the 512K — 380K is reserved just for screens. I started coding *Those Darn Marbles* about a year-and-a-half to two years ago. I first tried to squeeze the hardware scrolling into 128K, but I gave up.
Q. *How did you get the idea for* Those Darn Marbles?
A. I had looked into the capabilities of hardware scrolling and figured something using the techniques would be fairly impressive. I was also a fan of the Amiga version of *Marble Madness*, and I felt it could be done as well on the CoCo.
Q. *How did you incorporate those fancy sound effects into the game?*
A. *Studio Works* was used exclusively to digitize the voices and sounds, and I supplied the voices. I did a Mickey Mouse imitation: I spoke with my voice as high as I could, then I slowed it down so that it sounded natural but a little stretched out.

The "boinks" you hear when the marble falls off a path is the sign-on sound from a Macintosh computer. When you bounce off walls, the "bong" sound you hear is produced by a sitar, a Hindu lute.
Q. *The program comes on four disks. Isn't that a lot of code for just a few disks?*
A. It used to take eight disks, having a disk for every level. I compressed the files using Hoffman encoding.
Q. *This game is really funny — a refreshing break from kill-'em-dead arcade games! What prompted the "graffiti"?*
A. I call it "Planet of Enquirer Graffiti." The whole idea of the game is a silly, non-violent romp, if you will. Violence is becoming too prevalent in computer games. But I did *Overlord*, a military simulation, so I'm not one to talk. If the violence is abstract, obviously fantasy, then it's OK.
Q. *What can we expect to see next from you and your partner, Dave Triggerson?*
A. We are presently revising *Studio Works*, and we may have more games available later in the year, around September. I have no immediate plans for another 512K game. *The Winds of Orion*, a 3-D space flight simulation, is in the works. Whether it comes to fruition or not is not carved in stone. I hope to squeeze it into 128K.

❑

Software CoCo 1, 2 & 3

Div and *ConDiv* — Divide and Conquer!

As a volunteer in an elementary school, I help students all day. Part of my job is helping them with division problems. It's a tough job, but somebody's got to do it. Fortunately I like math — particularly division. However, sometimes I could use a little extra help doing it. *Div* and *ConDiv*, by XYORN, are two educational tutorials that address this need. You begin by typing in `RUN DIV`. As the program runs, it automatically loads *ConDiv*. *Div* creates white-on-black characters on my CM-8 monitor, which is similar to a chalkboard. It uses `PMODE 4 DRAW` strings to place letters and numbers on the screen, with provision for up to 36 columns.

The first menu allows you to create a computer-generated example, work on your own problem or work a computer problem. For example, let's say you have 1735/12. The computer performs each division step by step, instructing you as to which keys to press to find the quotient.

The program waits for you to press the correct key before continuing. It shows you exactly where each digit should be placed. Remainders, if any, are dealt with in one of two ways: They can be left at the end of the problem or taken out to several decimal places. Remainders are not placed after the quotient, as in traditional division.

When you finish, the program returns to the main menu. Next, try doing your own problem, but remember that upper limits for the numerator and denominator are built-in so problems won't become too long on the screen. Again, find the answer on paper, then watch as the CoCo presents how to find the answer.

Working out your own problem and letting the computer choose the problem basically involves the same procedures. When it finishes finding the whole number part of the answer, the program asks if you either want to find the decimal part or do another problem.

The program includes an onscreen tutorial, but it's only available as instructions: You can't work your own problems on the screen or place digits into the quotient — the computer does that. You must work out your own problems manually (on paper) and compare your answer with the program's. But why go to all that trouble when the computer will do it for you?

I was unable to back up the disk, yet I could copy both files to another disk. No manual is supplied (or needed) to run the programs, but there are full onscreen instructions.

I found a few flaws with *Div* and *ConDiv*. For instance, they both have trouble taking a larger denominator into a smaller numerator, as 9/48.

Since the programs are in BASIC, I listed *ConDiv* and discovered an error in Line 592. It states: `'IF C<100 THEN 5770 ELSE`. Why is that line there? If the apostrophe were removed, the line would crash the program! Another problem is you can't exit without pressing BREAK. When I tried to divide by 0, the program ended with an error. This should be modified to tell the user an error has occurred — not produce an error and end the program. Also, one screen message contains a misspelling.

I think *Div* and *ConDiv* are useful for third-graders or older. The built-in samples mainly use four-digit numerators divided by two-digit denominators. However, the student can enter numbers of various sizes.

(XYORN, H. Fairchild, 43611 Serenity Court, Lancaster, CA 93535; $19.95)

— Lee Deuell

Software CoCo 3

Omni Utility 2.0— The Taming of the Floppy Disk

In the July '89 issue of THE RAINBOW I did a review of *Omni Utility 1.0*. I was really quite impressed with *Omni*. It was well-written, did what it promised and was a good value. In fact the only improvement I could think of was the use of more than one drive when making backups. Well, now we have *Omni 2.0*, which not only allows the use of multiple drives but has other improvements that make it an even better value.

Omni 2.0 is a disk utility for the CoCo 3 written by Greg Wittmeyer, offered for sale by GSW software. *Omni* comes on an unprotected 5¼-inch floppy disk with a 10-page booklet that explains what each function does. When you boot *Omni* you'll see a good-looking title screen. At this point you insert the disk to be worked on into Drive 0 and press any key. Then the main menu is displayed. On the right side of the screen is a box that lists the files on the disk. Also in the box are two asterisks: The file between the asterisks is the file to be worked on. The arrow keys are used to change the file between the asterisks.

The left side of the screen is a listing of 16 commands. To use a command, simply press the first letter of the command (I love a program this easy to use). Any time you want to work on a different disk, simply insert the disk and press BREAK, then the new directory will be in the box. Here is a list of the commands available:

Alphabetize: arranges the directory in alphabetical order
Backup: backs up disks (more about this later)
Copy file
Execute file: runs a file
Format disk (no more `DSKINI`!)
Information on disk: lists name, extension, type of file, format, length and which granules on the disk the file occupies
Kill file
List file: lists file to screen or printer
Move file: moves file to another disk or directory
OK disk: checks any or all tracks and sectors for errors
Print directory
Quit
Rename file
Sector editor (more on this later)
Update directory (use after you rename/kill/move a file)
Verify two files: checks two files (up to 64K each) to see if they are the same

When Backup is selected, another menu appears with six options (now for some new stuff). The user can choose from 0 to 3 for target and source drives (if he has a multiple-drive system), or stay with Drive 0 on single-drive systems. Also you can choose whether to back up an entire disk or just the granules used, which saves a lot of time. And if that is not enough you can also back up any part of a disk by giving *Omni* the beginning and ending track and sectors.

Another command that needs more explanation is the sector editor, which allows the user to scan an entire disk and make changes. When this command is chosen you are given five operations: toggle ASCII, jump to a different track and sector, modify sector, print sector to printer, and quit to return to main menu.

Also, the arrow keys can be used to jump to different sectors or granules. With the Sector Editor command the user can actually go into a file on disk and make changes in it (providing he has knowledge of the language in which it is written). To sum up, I liked *Omni 1.0*, and I love *Omni 2.0*. *Omni* makes it so easy to keep my working disks

NEW!

Window Writer 1.2

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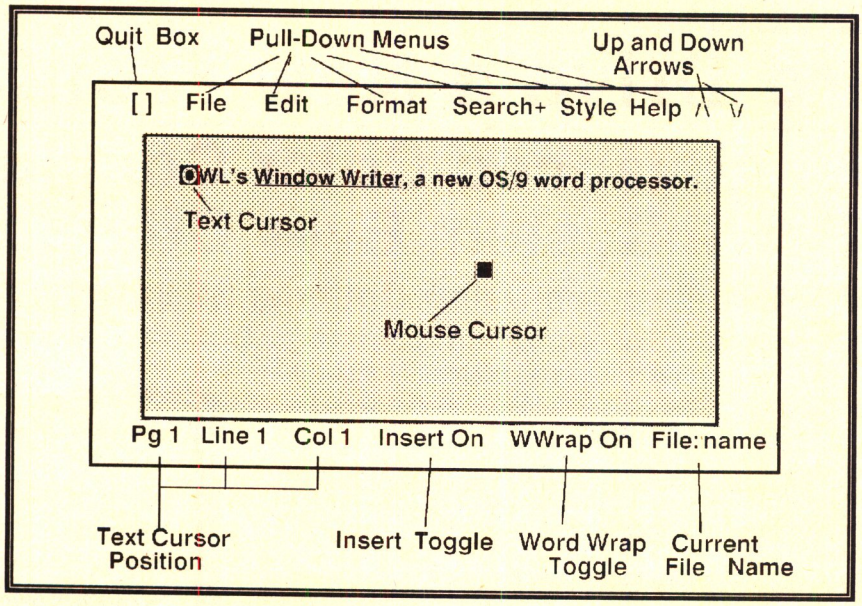

Quit Box
Pull-Down Menus
Up and Down Arrows
[] File Edit Format Search+ Style Help
OWL's Window Writer, a new OS/9 word processor.
Text Cursor
Mouse Cursor
Pg 1 Line 1 Col 1 Insert On WWrap On File: name
Text Cursor Position
Insert Toggle
Word Wrap Toggle
Current File Name

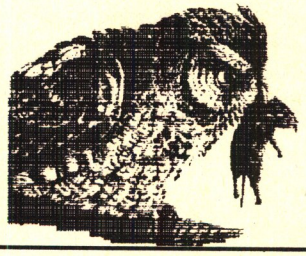
Pull Down Menus and Help Screens

A full selection of pull down menus and detailed help screens make learning easy and are only a key stroke (or mouse click) away. All menus and help screens can be user configured for everything including menu colors and contents. You don't like the color of a menu? You think one help item should be listed differently? Change them!

The menus and help screens can be reached by cursor keys or the mouse (or joystick) or can be accessed by control keys.

Hi-Res Display

Window Writer uses an **80-column monitor display** screen for clarity. As shown in the above screen drawing, you can quickly see how to access the menus and help screens. You can determine the current position by page, line number, and column. The mouse can use this section to quickly change to a specific page or line in the file. The text insert and word wrap toggles also are indicated and changeable with the mouse button.



French Version:
An abridged French translation of the **Window Writer** manual is now available. This manual is written by a Canadian CoCo user and will aid French speaking users. **Only $7.50 additional.**

Editing is a snap with OWL's Efficient Mouse Usage!

Editing

Like most modern word processors, with **Window Writer** there is always more than one way to access any editing feature. You can access editing by menus using mouse, "keyboard mouse", or through control keys. Full help screens are quickly available for all editing features. A help screen can be left visible while needed and then quickly removed to get back to full screen editing.

Ram Disk

A RAM disk is set up in **Window Writer** to make full use of all or a user specified portion of the memory on the 512K CoCo 3. On the 128K CoCo a smaller RAM disk is set up to still allow use of all available memory for file editing. For use of all features, a 512K machine is required.

The RAM disk is used for storage of the file(s) being edited, for the clipboard for cut and paste, and as a print spooler for the file being printed. **Window Writer's** clipboard can be saved to disk or pasted into any file being edited because files use the same clipboard memory. The RAM disk also can be used with other OS/9 programs.

Mail-Merge

With **Window Writer** you can create form letters and send them out to a list of addresses in an address file. First names or other information can be added to "personalize" these letters.

One nice feature is the price:

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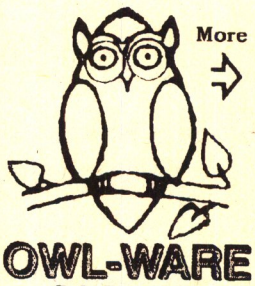

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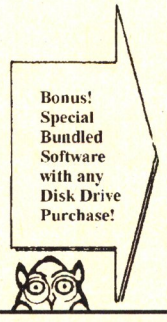

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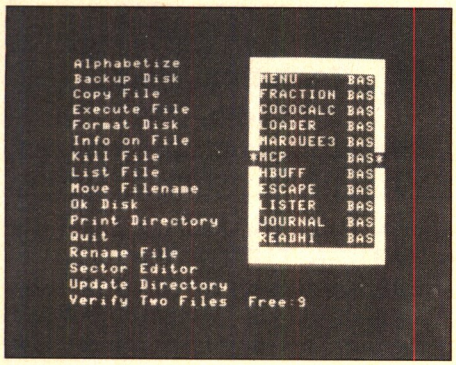
and backups up-to-date. Also, since *Omni 2.0* is so easy to use I found I would put more programs on a disk instead of buying more disks, which saves money.

Regarding the sector editor: To be honest, if I found an error I really wouldn't



know what to do. But I would like to add that even after reading numerous articles on disks and the various languages, I have learned more about both after using *Omni* only for a short time. In conclusion I feel *Omni 2.0* Is a very good buy; it's ease of use with the number of options it offers makes *Omni 2.0* a good value for the price. Anyone with a disk drive could put *Omni* to good use.

(GSW Software, 8345 Glenwood, Overland Park, KS 66212; $20)

—Steve Griffith

Software OS-9 Level II

S — Screen Control Utility — Commanding the Screen

Anyone who has tried to manipulate the text screen under OS-9 while writing shell scripts has run into the infamous `display` command. This command uses a series of hexadecimal codes to do things such as clear the screen, make the cursor blink, use reverse video, etc. For the normal computer user these codes are impossible to try to remember. Enter *S — Screen Control Utility.*

S is a small, 509-byte module that allows you to enter two-character mnemonic codes to accomplish 37 screen functions. At the command prompt, or in a shell script, simply type `s` followed by a series of codes:

```
s br bb 'Enter Selection' eb er rb
```

This command begins reverse video, begins blinking and prints the message "Enter Selection." The remaining codes end blinking, end reverse and ring the bell. The net effect of this command is that the message is in reverse video, blinking with the bell sounding to get the user's attention. To do the same thing with the `display` command you type the following:

```
display 1f 20 1f 24
echo Enter Selection
display 1f 25 1f 21 07
```

Now, you tell me which is easier! As I noted above, *S* supports 37 mnemonics and the ability to print text. Space doesn't permit me to list all the options, but they are listed in the windows section of the OS-9 manual.

Although *S* supports the ability to end the current window or an overlay window, it does not create these windows. This is something that should be included in *S* to make it complete, and I hope the authors will do so.

Perhaps some of you are saying this is nice, but you don't write many shell scripts. If you have installed *Shell+* (a replacement shell available from Delphi and CompuServe), you can do a lot of neat things with *S* and *Shell+*. You can do even more with BASIC09 and *S09*. *S09* is the second part of the *S* package that provides the BASIC09 programmer with the same mnemonic codes that *S* does but with even more capability. For the above example one could define a BASIC09 string as follows:

```
Dim op:string[80]
op:="br bb 'Enter Selection' eb er rb"
```

Then every time you want to place the message "Enter Selection" in reverse video (with blinking and the bell sounding), you type `run S09(op)` in the BASIC09 code. *S09* allows you to define a number of strings at the beginning of a program and call them at appropriate times.

The *S09* program also provides input capability. If we define the variable `ip` as `ip:=string[10]`, then `run S09(op,ip)` will print the message as above and wait for the user to type in a response up to 10 characters long. The input string can be defined for any length of characters allowed by BASIC09. For the example we have been discussing, `ip` would be defined as one character for a menu response.

The *S/S09* software package is very simple to use, yet provides a lot of capability. Either module is easy to install by simply merging the program to a module, such as `shell`, that is usually loaded into memory during system booting. Finally, the modules' small size allows them to be permanently included in the boot. I strongly recommend the *S/S09* package to anyone who regularly uses OS-9.

(r3 Systems, 4072 E. 22nd St., Suite 178, Tucson, AZ 85711, 602-745-2327; $19.95 plus S/H)

—Donald Dollberg

Software CoCo 3

UpDOS— DOS Is Looking Up

Hey, Vern, I see you have a CoCo 3! Neat machine, isn't it? Yeah, I think so too. Hey, wait, I see you're still using plain old vanilla Disk BASIC! Haven't there been times when you wished there were a few more commands and functions? You know, your CoCo can do a lot more. Like what? Well, take your disk drive over there. Did you know that thing is actually double-sided? 40 tracks? Can step at 6 ms? And did you know that your CoCo 3 has true lowercase? That you can boot up with any screen width and palette selection? That you can actually save all those nifty graphics you create? How do you get all this stuff? Funny you should ask — I just happen to have my *UpDOS* program with me. Check this out . . . .

UpDOS is a program that makes numerous patches to Disk Extended Color BASIC to give your CoCo 3 more commands and functions — and thus *power*. It is an addition to the line of alternate CoCo DOSs that deserves your consideration. The first thing about *UpDOS* that caught my attention was the clear, complete and informative documentation that came with it. The 27-page manual is well-written and organized, and it completely explained all the features the program makes available. In addition, there is a special technical section in the back for those wanting more detailed explanations of some of its functions. The *UpDOS* package works without any errors or problems and is very user-friendly.

UpDOS adds several new commands to Disk BASIC. First and foremost are the `HSAVE` and `HLOAD` commands. Using these it is possible to save, and later retrieve, high-resolution screens. The screens can be saved in one of two formats, selected when *UpDOS* is configured to your particular system:

"Poker Showdown, a video game of high tension and realism"

—*The Wall Street Journal*, March 15, 1990, page 1

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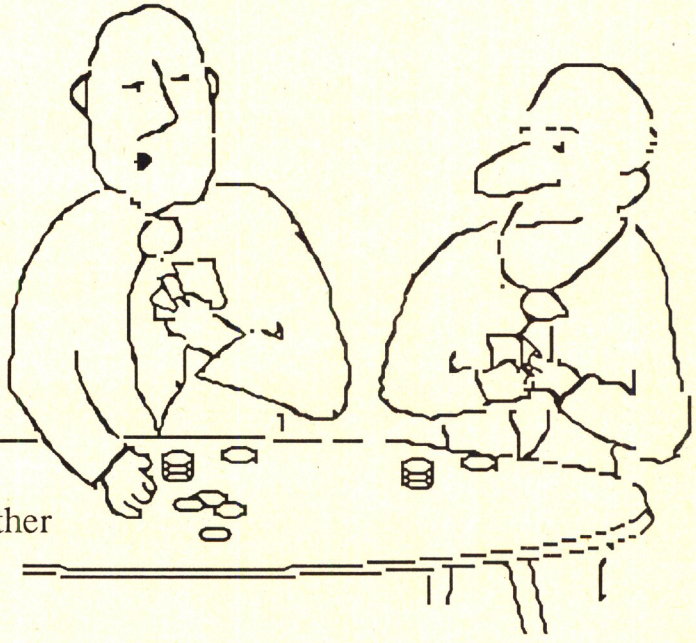

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.MGE format is that used by *Color Max 3* and the .CM3 format is used by *CoCo Max III*. You don't need either of these programs to use *UpDOS*, but saves you make will be compatible with them. *UpDOS* allows both types of formats to be compressed to save disk space. Another new command is the HVIEW command, which is the same as an HSCREEN command but doesn't erase the graphics page.

Some additional commands are AUTO, which allows automatic line numbering when entering BASIC programs; RUNM, equivalent to a LOADM and EXEC for machine language programs; BORDER, for changing the border color in the Hi-Res graphics and text screens; and UNDO, which removes many of the changes that *UpDOS* makes to Disk BASIC, allowing the running of some programs that would otherwise not be compatible with *UpDOS*.

A few commands have been enhanced by *UpDOS* to provide more capabilities. You can enter DIR,W to see a directory listing in multiple columns, allowing more files to be viewed at once. There is a "Copy filename to drive" command, as in COPY "MYPROG.BAS" TO 1, allowing saves from one disk drive to another without your having to retype the entire filename. EDIT *xxx,yyy* copies BASIC line *xxx* to line *yyy*, useful when the same line is used elsewhere with only a few or even no changes. PCLEAR can now be entered with a value up to 16 in order to reserve more space for low-resolution graphics.

UpDOS adds some very useful functions that are enacted with but a few keystrokes. ALT-F and ALT-S change the CPU speed to fast or slow while maintaining the correct printer baud rate. ALT-O toggles true 32-column lowercase. ALT-P toggles the dual output to screen and printer. SHIFT-ALT-BREAK does a cold start. (It is nice to be able to do a cold start without having to reach behind the computer to probe for the reset switch.) *UpDOS* also allows you to recall and edit the last command line entered. All BASIC functions can be entered in lowercase, and the program can be configured to boot up using lowercase. The only problem I found with this is that while editing it isn't possible to use lowercase to issue commands (such as insert or delete) so it is necessary to shift each letter or do a shift-lock.

UpDOS can be configured to your particular system using the menu-driven configuration program. Several options are available in this program that expand the power of the CoCo 3. You can choose either 35-or 40-track drives, single- or double-sided, at any step rate between 6 and 30 milliseconds. There are several features that are executed on power-up with *UpDOS*. The screen can be set to come up in either 32, 40 or 80 columns, with any foreground/background color combination. For those using monochrome monitors, the color burst can automatically be disabled. Finally, upon power-up *UpDOS* can automatically issue a DOS command or run a specified BASIC program.

UpDOS can be used as a program that is loaded in from the disk, or it can be burned into an EPROM, which replaces the standard Disk BASIC ROM. When using *UpDOS* from disk, all of the configurable power-up options are executed when you first load the *UpDOS* program from disk, but not upon subsequent cold starts (*UpDOS* must be reloaded from disk).

I think you will find *UpDOS* a useful addition to your CoCo library, and that using this well-designed and user-friendly product will be a joy.

(ESP, P.O. Box 63065, Wichita, KS 67203, 316-722-7442; $24.95)

—Michael G. Toepke

Software CoCo 1, 2 & 3

Paladin's Legacy — Have Sword, Will Travel

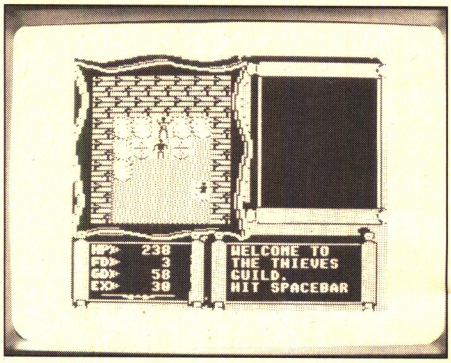
Paladin's Legacy is a fantasy role playing Adventure designed to work on any CoCo with a minimum of 64K and a disk drive. In trying to be compatible with every CoCo model, the program relies heavily on color artifacting and therefore loses crispness if viewed on an RGB monitor. So graphics are actually clearer with either a composite monitor or a TV set.

Paladin was a mythical figure who single-handedly brought peace and order to chaotic Tarinth, a land inhabited by elves, dwarves and humans. After 200 years of tranquillity, horrible, unearthly creatures are once again prowling the land, attacking at will and have gone so far as to kidnap the king. Moreover, the king is the protector of Tarinth and its five cities. The citizens of Tarinth now seek a champion to locate and rescue their king and hopefully restore peace in their land. The task is not an easy one.

The game allows you to create your own champion, give him a name and choose his attributes (strength, dexterity, wisdom and intelligence). Once you've done this, your champion is placed onto the terrain to fend for himself. You move around by pressing the arrow keys, but be careful as unprovoked attacks by a variety of beasts are constant. Once your hero has fought off attackers — accomplished by pressing the space bar — he earns gold and experience points. Gold can also be obtained by finding treasure chests.

In order to survive, you need to find some sort of weapon and armor as soon as possible. It may also be prudent to pick up a snack, lest you die of starvation. Food, weapons, armor and information can be obtained in five cities. Once a city tower or door is found, place your character on top of it and press E to enter the city. At this point the program prompts you to flip the disk over so that the required data can be loaded for your activity in the city.

When the character leaves the city, the disk is again flipped to get back to the playing field. One unique feature of the game is that it allows you to "talk" to any of its citizens. By moving your player in front of the person you want to address and



pressing T (for talk), you can gain some hints, clues or information. It is not enough to be an able-bodied swordsman or a great combatant, as you must also be able to manage your gold properly. It costs 1000 gold pieces, for instance, to buy a boat needed to sail across the waters. Special equipment, such as boots to scale the mountains or heavier and better armor, can all be bought at stores in the cities. Magic — which enables someone to walk through walls — can also be obtained by a clever adventurer. You can even have an audience with the queen, who may or may not give you a promotion to the next level.

To help the weary adventurer, a continuous run-down of the character's current status is displayed on the screen. This lists the amount of food and gold and how many hit points you have. Further information, such as what armor you are wearing and what weapon you are wielding, is found by pressing S (for status). In fact, all commands are simple one-letter commands: A for Attack, B for Board boat, D for Drop, E for Enter, L for Leave boat, etc.

Six pages of instructions, including a background story, accompany the flippy (a

floppy disk that you flip over). These instructions adequately cover everything the adventurer needs to know. Games can be saved and recalled, and when death comes — as it surely does — the game allows you to go to an area and be resurrected instead of rebooting and starting all over.

One side of the flippy is copy-protected so that the user can only back up one side (which is like getting one side of your car insured). Furthermore, the instructions start by stating: "...thank you for purchasing this software instead of pirating it." True, pirates exist, but why insult your customer's integrity? If he is reading the instructions, chances are he bought the item and should not be subjected to such comments!

While the constant flipping gets to be annoying and the graphics resolutions are minimal, operation and movement are smooth. The role-playing connoisseur will probably not mind parting with the money to play *Paladin*. The novice, on the other hand, may soon tire of pressing the space bar or may die of starvation before ever really getting involved.

(Sundog Systems, 21 Edinburg Drive, Pittsburgh, PA 15235, 412- 372-5674; $24.95)

— George Aftamonow

Software CoCo 3

A World at War— Revised and Improved

In the November 1989 RAINBOW (Page 110) is a review of *A World at War*. In early December 1989, I was assigned to review this game for a second time. RAINBOW seldom reviews the same product twice unless revisions are so extensive that it is virtually a new product. So, what gives?

As I began examining Greg Wittmeyer's new offering, I kept the November review by Greg Snow beside me. It is a favorable review, but it does contain some minor criticisms. I am pleased to see that the new version appears to have been coded with the review right beside the computer. All the original positive features are still there, but each of the previous areas of criticism is now improved. I believe any programmer who responds that rapidly and positively to a review will probably provide excellent customer service and product support.

The original version is written for the CMP palette and does not contain any convenient way to modify the version for an RGB Monitor. I've displayed this game using default CMP colors on an RGB Monitor and it's not bad, but compared to what it should be, the loss in artistic merit is worth mentioning. The new version provides a well-implemented Color Slot Code Editing option along with partial documentation. Fortunately this editor displays each color chip along with the color code and slot it is placed in. Unfortunately, Mr. Wittmeyer does not have an RGB monitor to play around on, so he avoids providing a list of the preferred RGB color codes for each slot. Wittmeyer is correct in his observation that people set their color and hue controls so differently that what I like and consider "peach" may or may not be what you consider peach. I will list the color codes you might use to start with in setting up the RGB palette (see Table 1).

I played two or three games using the default CMP palette on my RGB monitor. The visuals are impressive and the games fun. Then I converted all the files on the two disks to the equivalent RGB codes and tried running them again. I found amazingly beautiful improvements to what was already a good product. If you own an RGB monitor, take the time to modify the color codes in each slot of each file; the results are worth the effort.

When Greg Snow reviewed this package, he found five ready-to-run *War* files plus a blank default file on which to practice editing. I found six plus a blank. My

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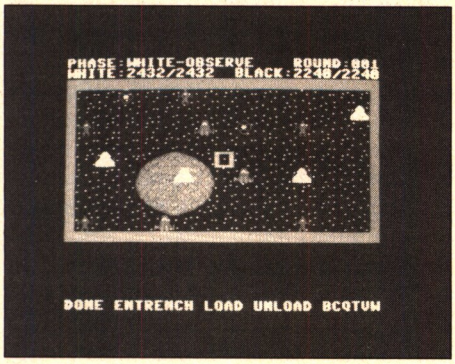
selection differs from his, and I would like to get copies of both sets for variety. My choices include one involving magic characters in a dungeon; another covering the Pacific Theater Campaigns of 1941 to 45;



two futuristic space wars; a land warfare exercise; and a battle that seems like a college fraternity game — you capture flags and your weapons are actually water balloons!

But the packaged wars are not the major attraction. Like Snow, I am very impressed with the high quality of Wittmeyer's make-a-war-yourself editors. The icons for the fighting units allow multiple variations of such staples as tanks, artillery, ships, submarines and planes. The fleet of spaceships supplied would make a Star Wars graphics designer envious! Plus there are various little men and horses — with or without armor — which provide additional variety and can be made into all types of magical figures (if Dungeon-and-Dragon types are your thing). Because of the excellent Icon editor, this collection is only your starting point!

The screens are a little larger and more detailed than Greg Snow describes in his review, and the maps now *look* like maps. Speaking of maps, the Terrain editor is as well-implemented as the Icon editor. Before you start using the Terrain editor, be sure to tour all 200 terrain features available in each of your seven files (1400 features in all). Many features have been repeated, but definitely not all of them. This is also true of the icons. And in setting up your map, the Fill feature that Snow requested has been provided.

The manual supporting all this is now over 30 pages (as opposed to 22 in the old version) and is reasonably clear and well-written. However, it still must be read more than once because this software has so many options and is so complex. A summary sheet of the commands is provided. The one item (besides the RGB Table) I feel is missing is a figure showing each menu for reference: It would speed learning.

The Append function allows you to combine features from different games. At one point I tried a war that included magic elves, nuclear weapons, aliens with laser cannons and modern tanks and planes. It got a bit messy and I do not recommend such extremes normally, but it can be done.

My negative comments? Well I have two, both minor. First, only Drive 0 is supported for all reads and writes. Because the starting library contains two disks and each disk only holds four files, frequent disk swapping is annoying. I also have reservations about whether RAM disks and hard disks can be used without problems. My second comment is that I had to kill all power to exit a demonstration game I devised of the computer playing itself. I later found out pressing BREAK exits a demonstration game, though only after a sequence is completed. Since I had constructed a large demo, turning off the CoCo proved to be less time-consuming than waiting for a cycle to end.

I am a reserve officer employed in the defense industry. Both as an operations analysis principal engineer and as a pentagon full colonel, I have played serious war games for a living. Currently, one of the better games contains unit and map editing software based on programming concepts very similar to those used here.

One final comment: When all the possible units (60 per side) and all the options are in use at once, this game slows down quite a bit. Do not be seduced by technology. An adequate and exciting game can be built with fewer players (hence, more speed). After all, football is considered a war game and uses 11 players rather than 60 on a side. Hmmm — I'll bet I could make *A World at War* play soccer (without that obnoxious ticket taker). Let's see, what color should I make . . .

(GSW Software, 8345 Glenwood, Overland Park, KS 66212, 913-341-3411; $25)

— Larry Elman

Slot #	Desired Color	GSW CMP Code	Equivalent RGB Code
0	Black	00	00
1	Red	07	36
2	Blue	12	09
3	Green	01	18
4	White	63	63
5	Yellow	36	54
6	Orange	22	38
7	Purple	10	12
8	Medium Grey	32	56
9	Dark Grey	16	07
10	Light Green	17	23
11	Dark Green	03	02
12	Light Blue	28	25
13	Pink	24	46
14	Brown	05	04
15	Peach	54	60

Table 1: Suggested Color Codes

Software

CoCo 3

Predator— An Addictive Arcade/ Action Game

The mass marketing of box office hits has led to the sale of dolls, stuffed animals, cereals, toys and, of course, computer games. *Predator*, an action/arcade game based on the movie starring Arnold Swarzennager, has been programmed for the Color Computer 3 by Greg Zumwalt. *Predator* is published by Activision and marketed by Tandy. Game requirements include a composite or RGB monitor and good hand/eye coordination. Optionally you can use a joystick to play.

To get started, insert the ROM pack and assume the role of Major Dutch Shaefer, a highly-trained commando whose entire squad has been mercilessly wiped out by a cunning creature. Your mission, if accepted, is to hunt down the Predator.

You start each stage with ten life points that are reduced each time you touch or are shot by soldiers and creatures. You may

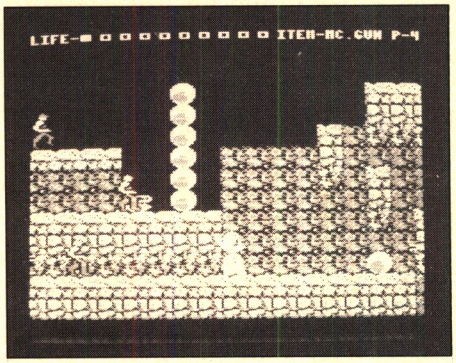
receive more life points at harder stages — a token of charity from *Predator*.

At first glance I was a little skeptical about the scenario: lots of jumps over and onto ledges and avoiding creatures that drain your life away. (I guess leaping from ledge to ledge is fine if you are a Rocky Mountain bighorn. Though if I remember correctly, bighorns don't have soldiers, scorpions or sea urchins shooting, stinging and nudging them into a great abyss every other step of the way.)

The first stage is set in a forest. With a minimal amount of hazards, this stage provides exercises to acquaint me with my new environment and player attributes — a boot camp of sorts. After jumping around and riding a scorpion or two, I found a rifle, which greatly increased my chances of completing Stage one. Each stage follows a pattern of teaching a new skill. Until I became proficient at using each skill, I remained at that level.

To complete a stage it is necessary to locate a cave entrance. On some stages two caves are visible, but only one advances you to the next level. The other may send you back to a previous stage. Soldiers, scorpions, boulders with eyes, seahorses, bats, fish, urchins, plants, laser-emitting forms and other assorted pesky, tenacious creatures will try to thwart your progress.

The stages I managed to get through — scathed though alive — were the forest, cave and aquatic settings. You must maneuver through 30 stages to defeat the Predator. Stages progressively become more



difficult to exit and require cunning plans of execution. As available weapons vary (rifles, grenades and laser guns), you are able to use different tactics. When you reach Stage 11, you'll find the amount of creatures and obstacles present almost overwhelming.

Each stage's difficulty increases beyond jumping ledges and destroying small stone barriers. Ledges shrink and barriers become massive walls. Clearing the stones is no longer a mere feat of demolition — they must be cleared to avoid creatures while still leaving access to stairs, pathways and bridges.

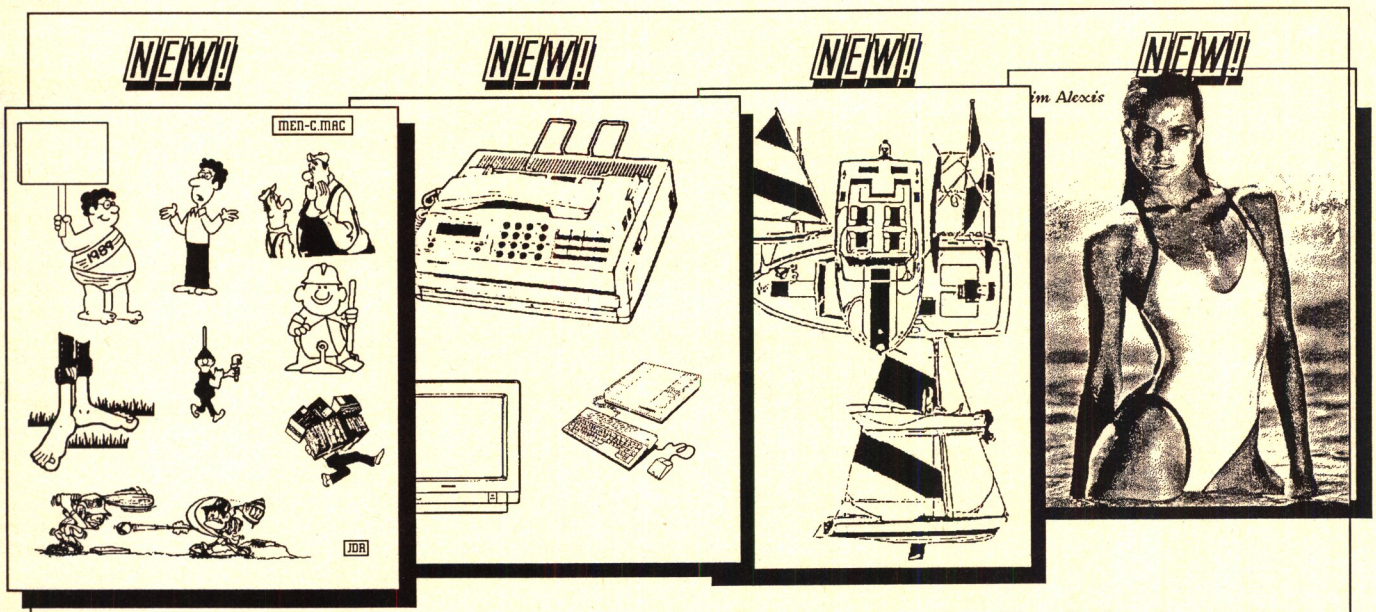
Each level presents a colorful array of creatures, moving to and fro. What struck me most was the amount of information stored in this ROM pack. Why don't other game ROM packs offer comparable programming techniques?

Unfortunately there is no save feature in *Predator*. However, there is a Continue option that allows you to continue from the last stage successfully completed. This option works fine until the computer is reset or turned off.

In conclusion, *Predator* provides plenty of playing time and varied screen scenarios. The graphics are good on RGB or composite monitors. The sound effects add the excitement of lasers, explosions and gun fire. After reaching higher levels in this game you won't want to turn your computer off and restart from the beginning. Let me forewarn you, *Predator* is an addicting action/arcade game!

(Activision, distributed by Tandy Corporation, 1700 One Tandy Center, Fort Worth, TX 76102; $34.95)

— Tony Olive



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Received and Certified

The following products have recently been received by THE RAINBOW, examined by our magazine staff and issued the Rainbow Seal of Certification, your assurance that we have seen the product and have ascertained that it is what it purports to be.

◆F **Bible Scriptures**, a program that presents scriptures and requests of the user the appropriate book, chapter and verse. The program can be customized by changing the information in the DATA statements. The package also includes *A Bible Adventure* (a text Adventure written in BASIC), *A Journey to the Promised Land* (a combination quiz/text Adventure based on the Israelites' 40-year journey) and *Bible Questions Parts I, II* and *III* (a quiz covering general Bible knowledge, famous biblical personalities and famous Old Testament quotes). For the CoCo 2 and 3, requiring 64K. *Sebastian LaSpada, 531 Main St., Dunkirk, NY 14048, (716) 366-5261; $10.*

CIII Clipart, a collection of 672 pieces of clip art for the *CIII Pages* CoCo 3 desktop publishing program. Categories include cartoons, holidays, block letters, education, transportation, sports and more. The graphics were created in HSCREEN3 using the Magnifier tool from *CIII Pages*. Included is a viewing utility (supplied on each disk) that views graphics outside the *CIII Pages* environment. The collection comes on three double-sided disks and requires a CoCo 3 and *CIII Pages*. *Coless Computer Design, 1917 Madera St., #8, Waukesha, WI 53186, (414) 549-0750; $29.95 plus $3 S/H.*

CIII Fonts, a set of 59 different text fonts that supplement the fonts found in *Color Max 3, Color Max 3 Deluxe, CoCo Newsroom, Newspaper, Newspaper Plus, Newspaper Plus Final Edition* and *The Rat*. Requires a CoCo 3. The fonts come on three single-sided disks. *Coless Computer Design, 1917 Madera St., #8, Waukesha, WI 53186, (414) 549-0750; $19.95 plus $3 S/H.*

CoCo Cassette #92, the February 1990 edition of a monthly software subscription service. Issue #92's programs include the following: *Penta-Same* (a version of Yahtzee), *Rotisserie League* (a baseball owner/manager league), *Nick's Quest* (an adventure about "a guy named Nick who is hunting for the 'Wand of Wonder' to save his kingdom"), *Solitair* (a game), *Education 4* (four grammar lessons), *IBM — BASIC Difference* (discusses the difference between the CoCo's and IBM's BASIC), *Baseball Card Organizer* (tracks baseball card collections on tape or disk), *Munchy 3* (a machine-language *Pac-Man*-type game), *River Raid 3* (a CoCo 3 game in which the player maneuvers a "Raidboat" up a river), and *Cuber* (a machine-language *Q*bert*-type game). *T&D Software, 2490 Miles Standish Drive, Holland, MI 49424, (616) 399-9648; $8, $70 for a yearly subscription.*

◆F **Division**, an educational program that teaches the basics of long division. Users have the choice of solving a problem the computer randomly generates, or entering a problem of their own to solve. Written in BASIC for the CoCo 2. *Xyorn, Inc., 43611 Serenity Court, Lancaster, CA 93535, (805) 946-1349; $19.95.*

fileMASTER 2.2.1, a complete database management system for the CoCo 3 and two disk drives. This easy-to-use program makes file storage enjoyable. Import your *VIP* database files. Redefine old databases to accept new fields, change the cursor path, arrange label and page output. Loaded with advanced features. *21st Century Software, P.O. Box 430207, Kissimmee, FL 34743, (407) 348-0848; $69.95*

Joy, a software tutorial that shows users how to construct a working converter box that lets Atari-type joysticks work with CoCo programs. The procedure is illustrated step by step with CoCo PMODE 4 screens. "A complete list of parts and tools needed is supplied in the program with Radio Shack part numbers. Some electronic knowledge will be helpful, but nothing more than a hobbyist's level. A basic knowledge of soldering is a must!" *B&B Software, 1637 Hanchett N.W., Grand Rapids, MI 49504, (616) 453-1011; $6.50.*

◆F **Mystery**, a graphics Adventure game based on the board game *Clue*, written in BASIC. After a murder has been committed, you must explore the house to locate the body, determine which weapon was used and then expose the person responsible. The goal is to solve the game in the least possible moves. *Xyorn, Inc., 43611 Serenity Court, Lancaster, CA 93535, (805) 946-1349; $19.95.*

Overlord, a military simulation for up to three players (carbon-based or silicon). The goal is to conquer territory by forcible means on a hostile world. You use the industrial capabilities of the cities you conquer to produce more combat equipment, aircraft and ships. Strategy and preparation are the keys to success. Written in machine language for the 128K CoCo 3, *Overlord* requires a disk drive, mouse or a joystick. *Oblique Triad, 32 Church St., Georgetown, ON L7G 2A7, Canada, (416) 877-8149; $29 U.S., $34 Cdn.*

Pistol Grip Deluxe Joystick, a smooth-tracking analog four-button joystick (two firebuttons on the base, with one thumb button on top of the stick and one trigger button for the index finger). It has molded, aircraft-style finger grips, a suction base, switchable dual-control buttons, *x*- and *y*- axis trim controls and a 6-foot cable. It connects to a six-pin DIN analog game port, fitting both Color Computers and the Tandy 1000 family. *Tandy Corporation, 1700 One Tandy Center, Fort Worth, TX 76102; $29.95: Available in Radio Shack stores nationwide, Cat. No. 26-3123.*

Rampage, a CoCo 3 ROM pack game that advises you to "go ahead — get it out of your system. Lose your temper. Smash a skyscraper. Trash a city. Have an office building for lunch." In this game up to three players can work out their frustrations smashing and trashing a city as George the Big Ape, Lizzie the Lizard or Ralph the Wolf. Players can pick off helicopters and climb walls, punching holes and grabbing people and things as they climb. The monsters need to eat to keep up their energy levels: If your energy gets too low, you can turn into a human, and then your friends can eat you. *Activision, dist. by Tandy Corporation, 1700 One Tandy Center, Fort Worth, TX 76102; $34.95: Available in Radio Shack stores nationwide, Cat. No. 26-3174.*

T&D Software's Grafix Disk Package Set #3, a collection of 10 disks full of graphics files of "adult-only R-Rated beautiful women." *T&D Subscription Software, 2490 Miles Standish, Holland, MI 49424, (616) 399-9648; $35.*

Those Darn Marbles, a *Marble Madness*-type arcade game in which the player manipulates a marble down a 3-D maze, avoiding "Marble Munchers, Acid Pools and Jehosaphats." Gravity is a factor in the game, and it becomes readily apparent when you attempt to swing around a curve. Digitized sound effects are featured, and the program takes advantage of hardware smooth scrolling of the CoCo 3. The program moves seamlessly down its myriad screens. Players can fall off the edge, get "eaten" and fall into bottomless pits. The object is to reach the exit to each successive level before the clock runs out. Requires a 512K CoCo 3, a disk drive and a joystick. *Oblique Triad, 32 Church St., Georgetown, ON L7G 2A7, Canada, (416) 877-8149; $32 U.S., $38 Cdn.*

◆F **First product recieved from this company**

The *Seal of Certification* is open to all manufacturers of products for the Tandy Color Computer, regardless of whether they advertise in THE RAINBOW.

By awarding a *Seal*, the magazine certifies the program does *exist* — that we have examined it and have a sample copy — but this *does not* constitute any guarantee of satisfaction. As soon as possible, these hardware or software items will be forwarded to THE RAINBOW reviewers for evaluation.

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Sample Calligrapher CliPix Pictures

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Calligrapher CliPix - The Calligrapher may now include graphics pictures along with the text it prints. There are currently 9 different CliPix disks available, each one has over 60 different graphic pictures. While the OS9/MS-DOS Calligrapher may easily combine both text and CliPix, the RS-DOS (CoCo) Calligrapher may also print out the CliPix. **$9.95** each.

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Clearing the Paths

by Tony DiStefano
Contributing Editor

Last month we covered the tools you need to design and test a digital circuit. Now I'm going to show you how to use those tools to get the circuit working. Remember, take your time and be patient during this project. Look at any problems from all angles and don't leave out the obvious.

As an example of trouble-shooting, I just received a new 2400-baud external modem at work. It is my job to see that equipment works well before it's used, so I connected this modem to a computer and tried it out. All worked well, except it didn't hang up the phone when I gave it the proper command. I tapped it lightly and it worked. I thought something was loose, so I opened it up to take a look. There was nothing loose. I thought perhaps it was a short. Wrong. After a while I noticed that if I disconnected the telephone line and reconnected it, everything worked alright. So I thought it must be the relay. I checked the signal going to the relay and it was okay. It occurred to me that the contacts of the relay may have been sticking and the tap released it. This idea did not make complete sense. If the line was not connected, an ohm meter test said that the relay contacts did not stick. Yet when the line was connected, it would not let go. This was quite a puzzle.

After checking and checking again, I came up with nothing. Then I sat back and looked at all the facts. It would only stick when the line was on. What was in the line that would make a relay stick? Perhaps it was a magnetic field. The telephone line is a DC signal. A normal modem uses a transformer to couple the line to the rest of the circuits. A DC current through a coil makes a magnetic field. I checked the transformer. It was right next to the reed relay. Did I say *reed* relay? A reed relay relies on a magnetic field to hold its contacts closed. It seemed impossible, I know. I looked at the relay and noticed that in the assembly stage, the relay was bent and leaned right against the transformer. Could it be that the magnetic field generated by the transformer was holding the reed relay closed? The theory was perfect. I leaned over and bent the relay away from the transformer. The relay no longer stayed stuck when I told it to hang up. Well, this just goes to show you that nothing is too far-fetched.

Not all repairs are fun. Take a look at the do-nothing circuit in Figure 1. It has three chips, two 74LS139s and a 74LS32. The circuit does nothing more than some funny memory mapping. I am using this circuit as a means of showing you how to tackle trouble-shooting and how to check if the circuit works well. You may want to build this circuit, but remember, it doesn't do much. The power connections are not marked on this diagram (the CAD program I use does not show them), but here is the list: U1 and U2, +5V is Pin 16; ground is Pin 8; U3, +5V is Pin 14; and ground is found on Pin 7.

First give the circuit and board a careful visual check. Are the components in their sockets properly? Pushed down all the way? No pins sticking out? Now look at the solder side. Any solder shorts? Cold solder joints? Look at the edge connector. Is it clean? Any broken traces? Before plugging the circuit in, check to see that all the connections are made. Check them again, one wire at a time. When you think it's okay, check with a continuity meter for shorts between +5V and ground. There should be resistance, but not a dead short.

Now we are ready to plug it in. With all power off, plug in the circuit. Turn the power on and look for your regular screen. If it is not what you usually get, turn it off right away. If it powers up properly, proceed to the next step. If it does not, you have to determine what is causing the malfunction. It can be in the power or a line that connects to the computer's address or data lines. Check all lines to the computer for shorts or outputs directly to the address lines.

When building or trouble-shooting a circuit, it is best to understand how the circuit works. Look at Figure 1 again. To make sure this works, proceed at a logical level. In this case a volt meter and a digital probe are all the trouble-shooting tools you need. You'll need the standard tools, of course, to make repairs. Start with a voltmeter. Use the scale that gives you the most accurate reading at about 5 volts. Put the negative side to a known good ground and check to make sure there is 5 volts on every chip. This often solves the problem. Also check to make sure there is 0 volts on every grounded pin of every chip. An ungrounded chip can also be the problem.

When you are sure there is voltage and ground in every chip, use the logic probe. Set it to the TTL mode. It must be powered from the same circuit you are testing. To check the probe, check a known good ground and a known good +5 volts. The probe indicates the High and Low states properly, either with LEDs, sound or both. The signals from the computer are always changing, particularly the address and data lines. Check to see if these signals appear at the chips — that is, pins 2, 3, 13 and 14 of U1 and U2.

Tony DiStefano is a well-known early specialist in computer hardware projects. He lives in Laval Ouest, Quebec. Tony's username on Delphi is DISTO.

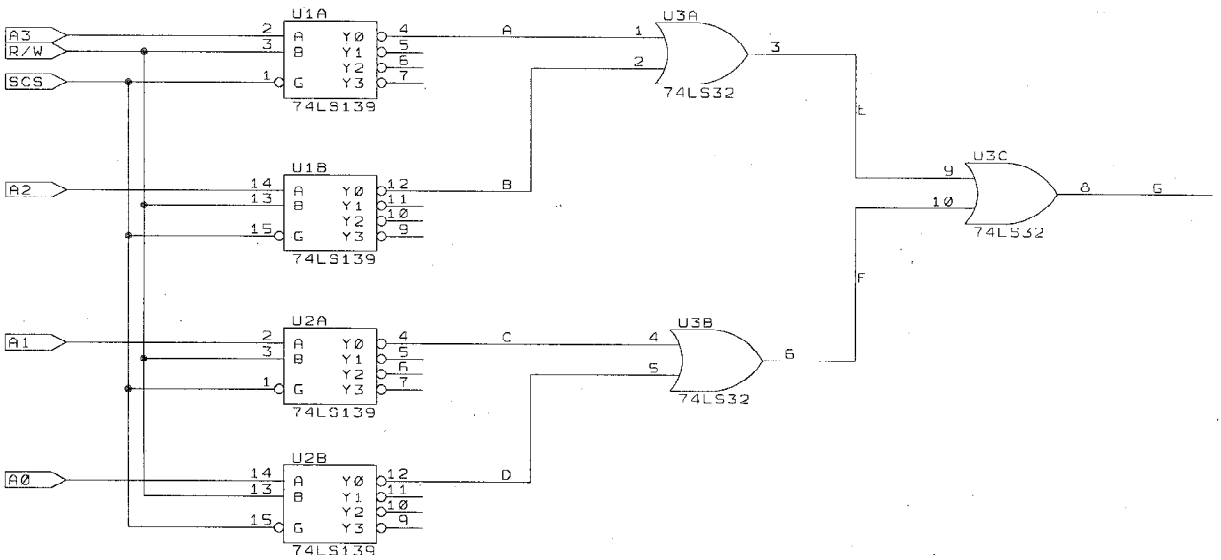


Figure 1.

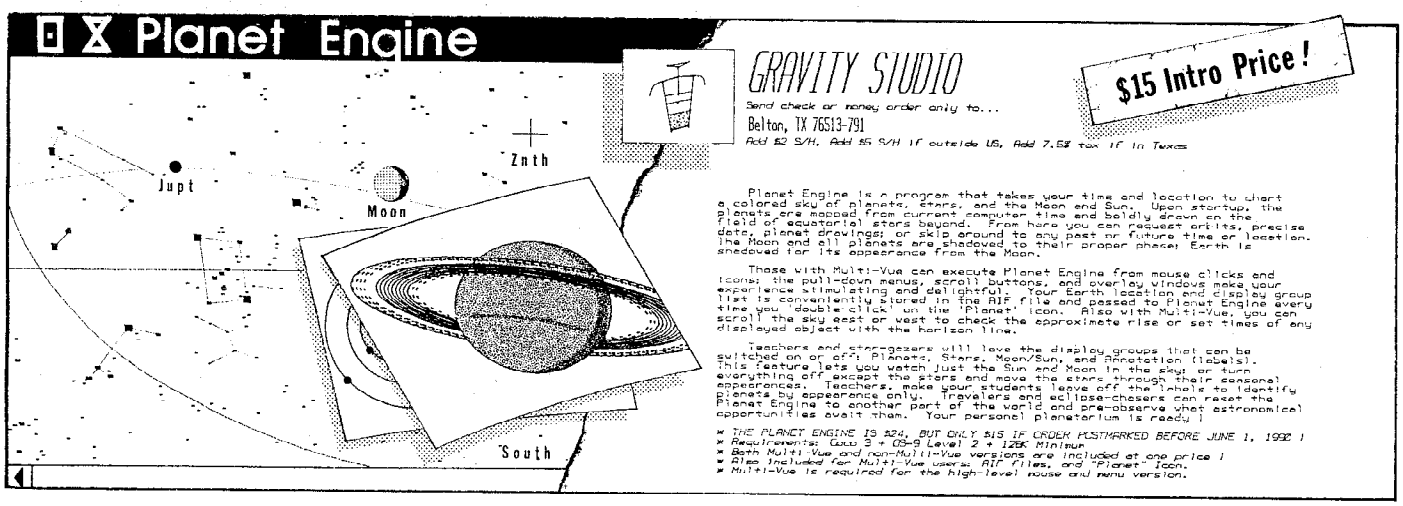
If there is not a signal at all of these pins, something is wrong with one of the pins. The probe should indicate an oscillating signal.

With all the above signals okay, test the circuit in action. From the diagram, address lines A0 through A3 work with the *SCS pin of the CoCo. We know the *SCS signal is active from $FF40 to $FF5F. Also, if you look at the diagram, the *SCS signal goes to every G pin of the 74LS139s. Let's start with U1A. The two inputs consist of the A3 address line on Pin A and the R/*W signal on Pin B. The only connected output is Y0. Therefore, using the logic diagram for a 74139 when G is Low, A and B have to be Low before there is a Low signal at Y0. This means a Write signal with A3 Low. The next gate is U1B, which is similar but with A2 instead of A3. Now we require that A2 also be Low. The third circuit is U2A. This is done the same way as with the A3 address line but this time with the A1 address line. The fourth and last is U2B, which is done the same way but with A0 as the A input.

You need a signal that activates only one of the four 74LS139s at a time. If you look at the binary number for A0 to A3, the number you need to activate U1A is $FF47 (0111 binary in the least significant byte within the *SCS range. A one-line BASIC program takes care of this:

```
10 POKE &HFF47,0 : GOTO 10
```

Type in the program and run it. With your probe, first test to see if the SCS pin is working. Put the probe tip on any pin with the SCS signal. Use Pin 1 of U1A; it is this circuit you are testing. The probe shows a small pulse from High to Low. You can tell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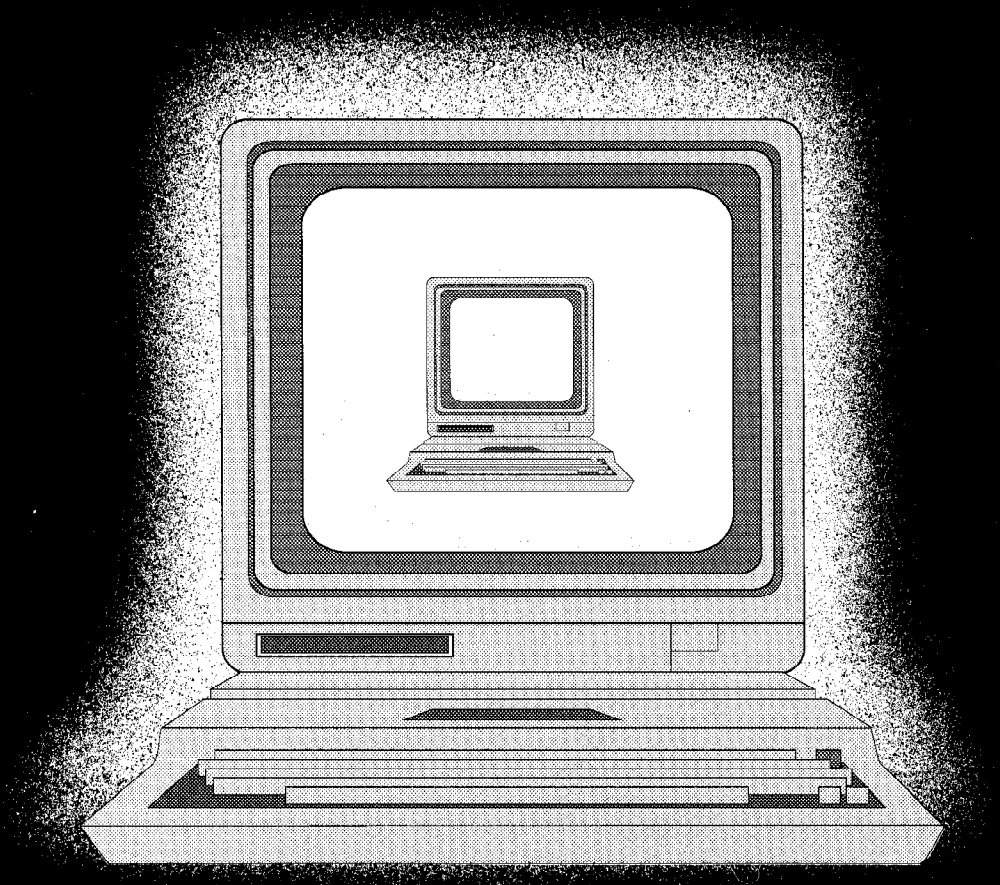

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this by the flashing LED or a warble in the sound. Remember, BASIC is slow and the pulse is real short. You may be able to tell only by looking at the LED. To be sure the input works, check the output. Put the probe on Pin 4 of U1A. You should get the same pulse. If you don't, check pins 1, 2 and 3 again. Now make sure the other three gates are not activated. Check the other three Y0s for no signal. Next, do the same for the other three gates. The new addresses are: &HFF4B for U1B, &HFF4D for U2A, and &HFF4E for U2B. When you test for one working gate, make sure the other three are not active.

You can safely say that the first two chips are working. Now you must test the next set of chips. Let's start with U3A. Think back to the truth table for an OR gate and remember you are using it as a Negative AND. Pin 1 and Pin 2 need to be Low in order to get a Low at Pin 3. You must change your software a bit in order to get both parts of U1 in the diagram to go Low at the same time. What is the value? Well, both A2 and A3 must be Low and A1 and A0 must be High. The value then becomes $3. Change the address to &HFF43 in your one-line program. Run the program and get the probe out. Y0 of U1A and Y0 of U1B should both go Low. The probe verifies this. Next, put the probe on Pin 3 of U3A; it too should go Low. If it is not, check to see that the pulses are appearing at the inputs of the 74LS32. Do the same with the other two 74LS139 parts and U3B. To do this, calculate the right address, edit the one-line program and run it again. This time, test the outputs of U2A and U2B. Check that they both go Low and that they reach the proper pins of U3B.

At this point you can see that you progress from the computer to the end result one step at a time, from the input of one gate to the output and then to the input of the next gate. You must know what each gate does and apply the theory to each gate. Then you must determine if that particular part of the circuit is working properly. If you don't get a proper signal at the output of a certain gate, check the inputs. If they seem to be right, you know there is power to the chip, because you have already checked it and you know the inputs work. You can then change the chip if you think that part is bad. Don't assume the part is bad just because it doesn't give you the right output.

Now take the next step. U3C is used as a Negative-Logic AND gate. When input A and input B are Low, output Y is Low. In order to make the output of U3C go Low, U3A and U3B must go Low. For this to happen, all four 74LS139 gates must be active. This means you must change the one-line program. Look at the conditions for this. A0 to A3 must all be active, which means four 0s. The new address becomes &HFF40. Edit the line and run the program. From the previous tests you know the outputs from U3A and U3B work. It is now just a matter of checking the final gate. Using the probe, check the output of U3C. It should work. If it does not, it can only be one of the two inputs. Make sure the signals from U3A to U3B arrive at their proper destinations.

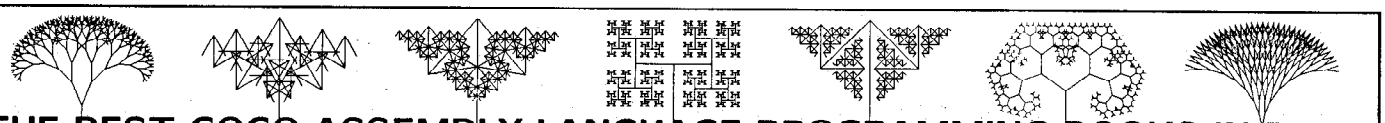
Up to now, all I have been using is a probe, but in a simple circuit like this, a probe may be the only tool you need. For every point along these tests, you could have used a scope instead. Procedures for using a scope are much the same. One difference is that most scopes have two channels. While this makes things a little faster by observing two signals at the same time, the real use for two channels is to compare one channel to the other. There is one drawback to using a scope. It is very fast and to be able to occasionally see one pulse (BASIC is slow), the pulse on the screen is very small. Also the sweep rate is so slow that the screen flashes, which makes it uncomfortable to work with. To get around that, I usually punch in a little machine language loop to store or load a byte into memory. I do this so often that I know the bytes by heart. Here is what I do:

```
POKE 4000,&H1A 'MASK INTERRUPTS
POKE 4001,&H50
POKE 4002,&HB7 'STORE COMMAND
POKE 4003,&HFF 'ADDRESS UPPER
POKE 4004,&H40 'ADDRESS LOWER
POKE 4005,&HB7 'BRANCH
POKE 4006,&HBF 'BACK TO THE STO
RE COMMAND
EXEC 4000
```

This program is just a short loop to write a value (usually 0 when using the EXEC command) into a memory location. I change the Write to a Read by doing one different POKE. The REM statements just let you know what is happening; I don't type them in.

Those of you who are lucky (or rich) enough to own a scope can try this dual channel test to examine the timing delays of TTL gates. With this circuit working (trouble-shoot, if not working), put one channel of the scope to Pin 1 of U1A. Run the little program above. Adjust the sync of the scope to gate a stable trace of the *SCS signal. Now with the other channel of the scope, look at the output signal of U3C. In theory, these two signals should be the same, but look carefully to see a slight delay between the first channel and the second. This delay is called the *propagation delay*. It is the time delay between the input and the output of a gate. The more gates used, the longer the propagation delay gets. When you are designing complex circuits like the Super Controller II or my new 1-Meg upgrade, these delays are very critical and must be taken into account.

The next topic of discussion is the logic analyzer. This design is the cream of the crop, but I am not going to go into this. If you need to have one, you know how to use it. This wraps up this month's article on trouble-shooting circuits. ❑



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The Assembly Line Part II: Get the Picture

by William P. Nee

Learning to manipulate graphics images can be fun and interesting. We'll look at a program that takes any PMODE 3 or PMODE 4 picture and modifies it 11 different ways. You can save your picture anytime, then continue modifying the existing picture or start again with a new picture.

The machine language program (Listing 1) uses the ORG command several times (lines 110, 340, 800, etc.). This wastes memory, but I wanted to make it easier to distinguish between the different routines.

The BASIC program first asks you to put the disk containing your picture into any drive, then for the PMODE (3 or 4), the filename and the drive number. After the picture appears, press any key to get the following menu options:

- Reduce the picture to half its height and display the image on the top of the screen.
- Reduce the picture to half its height and mirror the image at the top and bottom of the screen.
- Reduce the picture to half its height and copy the image to the top and bottom halves of the screen.
- Reduce the picture to half its width and display it on the left half of the screen.
- Reduce the picture to half its width and mirror it on the left and right of the screen.
- Reduce the picture to half its width and copy the image on the left and right halves of the screen.
- Flip the entire picture from top to bottom.
- Flip the entire picture from left to right.
- Reduce the picture to one-fourth its size and mirror the image at the four corners.
- Reduce the picture to one-fourth its size and copy the image at the four corners.
- Undo all modifications and display the original picture (but in the current PMODE).
- Toggle the PMODE from 3 to 4 or from 4 to 3 and redisplay the current modified image.

Now let's see how the various machine-language routines accomplish each of these modifications. Several of these routines are called more than once, especially when using the four-corner options, since there are differences in setting colors in PMODE 3 and 4. There are also different routines for the same menu options, depending on the PMODE. All the routines use the initial graphics on pages 1 through 4, convert them to pages 5 through 8, then transfer the new picture back to pages 1 through 4. Doing this on a byte-for-byte basis really speeds things along. Routines R1 to R10 ($6100 to $6C00) are primarily for PMODE 4 graphics, but I'll point out those that also apply to PMODE 3.

The first routine, R1 (lines 110 through 320), reduces a PMODE 4 picture to one-half its height. Register X contains the start of Page 1 graphics ($E00), and Register U contains the start of Page 5 graphics ($2600). Lines 180 through 220 get the first byte of the graphics data and OR it with the byte directly below it. This is necessary in PMODE 4 graphics because of the fine resolution capabilities. Without checking two lines at once for set points, the modified image could end up with a lot of blank spaces where there should be some detail. The result is the first graphics byte on Page 5. The PCOPY routine (Line 320) transfers the graphics back to pages 1 through 4.

Routine 2, R2 (lines 340 through 780), reduces the picture to one-half its width. Just as R1 reduces a picture by comparing a byte to the one just beneath it, this routine compares a bit to the one next to it (for our purposes, two consecutive bits are one nibble). The width of a graphics image is reduced on a nibble-by-nibble basis.

Register A gets the first graphics byte and uses the BIT command to test it (Line 430). The BIT command is the same as the AND command but only changes the Condition Code Register and does not affect the register being tested. The #192 in Line 430 represents the result of only the left two bits (first nibble) being set (128+64=192). Register B contains the final result, so if either Bit 7 or Bit 6 in Register A is a 1, the left-most bit in Register B is set (Line 450). The next two bits in Register A are checked (32+16=48) and if either is a 1, the next bit in Register B is set (Line 480). This procedure continues through all of Register A. When the first byte is checked, Register B is only half filled, so we need to get the next byte (Line 550) and test its four nibbles. When this is complete, Register B contains

---

Bill Nee bucked the Snowbird trend by retiring to Wisconsin from a banking career in Florida. The success of this 13-part series "Machine Language Made BASIC" prompted him to continue writing articles on machine language programming. You can contact Bill at Route 2, Box 216C, Mason, WI 54856-9302.

the result of checking two bytes and can be transferred to pages 5 through 8 (Line 680). The result is transferred back to pages 1 through 4.

Routine R3 (Lines 810 through 980) flips a picture along the horizontal axis. Register X contains the first graphics location on Page 1 and Register U contains the bottom-left location on Page 8. Graphics are transferred on a byte-for-byte basis. When Register U reaches the end of a line, it has been automatically increased by 1 (STA ,U+), so it is necessary to go back up 64 spaces (LEAU -64,U) to drop back one line. Since there is no check for bits, this routine can be used in PMODE 3 or 4.

R4 (lines 1000 through 1450) flips a picture along the vertical axis. Register X contains the top-left graphics corner on Page 1 and Register U contains the top-right graphics corner on Page 5. Since not only each byte but also each bit is flipped, we need to test each bit to see if it is a 1 and, if so, set the corresponding bit. Starting with the left-most bit, each one is tested; if it is a 1, the right-most bit in Register B is set to 1. The reversed byte is then stored in the upper-right corner of Page 5. This procedure continues through all four pages.

The next routine, R5 (lines 1470 through 1960), is used in conjunction with R2 (half width) to produce a mirror image along the vertical axis. This routine is almost the same as the previous one, but Register Y contains the upper-left corner of Page 5. The reversed byte is stored in the upper-right corner of Page 5, and the original byte is stored in the upper-left corner. Because R2 reduced the original picture to half its width, R5 now creates a half-size mirror image.

Since not only each byte but also each bit is flipped, we need to test each bit to see if it is a 1 and, if so, set the corresponding bit.

The sixth routine, R6 (lines 1980 through 2180), is used with R1 and R11 (half-height) to create a mirror image at the top and bottom of the screen. Register Y contains the top-left graphics address of Page 5, and Register U contains the bottom-left graphics address of Page 8. The half-size image is reproduced on pages 5 and 6 and the flipped image on pages 7 and 8. Since this is done on a byte-for-byte basis, the routine works in both PMODE 3 and 4.

The SAVE routine (lines 2200 through 2310) at $6700 saves the original picture in high RAM starting at $8000. Note that the interrupts are enabled in Line 2230 and restored in Line 2300. The BASIC program automatically calls this routine once you've loaded the picture. The SHOW routine (lines 2330 through 2440) at $6800 is the reverse of the SAVE routine and redisplays the original picture (in the current PMODE) when you select Option 11. Again note the interrupts in Line 2360 and Line 2430.

R7 (lines 2460 through 2680) at $6900 copies an image in the upper-left corner to all four corners on pages 5 through 8. This modification is normally used with other routines that reduce a picture to half its width and half its height. Since the graphics

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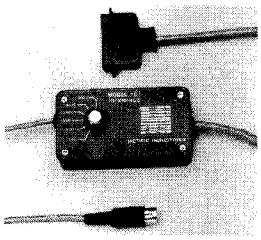

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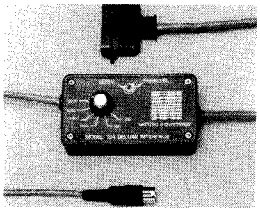

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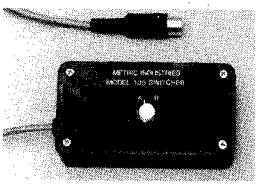
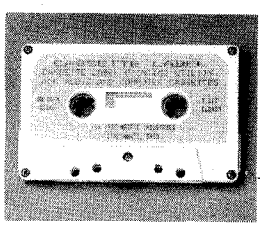


Model 105 Serial Switch

★ Connects to your COCO to give you 2 switch selectable Serial Ports
★ Comes with a 3 foot cable to connect to your computer
★ Now you can connect your Printer (or printer interface) and your Modem (or other serial device) to your COCO and flip the switch to use either device
★ Does not require power



Cassette Label Printing Program

★ **New Version 2.1 prints 7 lines** of information on Cassette labels
★ Comes on Tape with instructions to transfer to disk
★ Menu driven, very easy to use
★ **Save and Load Labels from Tape and Disk**
★ Uses the features of your printer to print standard, expanded, and condensed characters
★ **Automatically Centers Each Line of Text**
★ Allows editing of label before printing
★ Program comes with 24 labels to get you started
★ 16K ECB required

Some of the Printers That Can –
Supply power for the 101 and 104 are Radio Shack, Star, Okidata, Brother, Juki, and Smith Corona.

Some of the Printers That Cannot –
Supply power for the interfaces are Epson, Seikosha, Panasonic, Silver Reed and NEC. If your printer cannot supply power to the interface you can order your interface with the "P" option or you can supply your own AC adapter. We recommend the Radio Shack 273-1431 AC adapter with a 274-328 connector adapter.

Write or call for more information or for technical assistance.

Price List

Model 101	**35.95**
Model 101P	41.95
Model 104	44.95
Model 104P	51.95
Model 105	14.95
Cassette Label Program	6.95
Pin Feed Cassette Labels:	
White	3.00/100

4 Pin Din Serial COCO Cables:

Male/Male 6 foot	4.49
Male/Female 6 foot	4.49
Female/Female 6 foot	4.49

Other Lengths Available.

All items covered by a 1 year warranty

Ordering Info

★ **Free Shipping** in the U.S.A. (except AK and HI) on all orders over $50
★ On orders under $50 please add $2.50 for shipping and handling
★ On orders outside the U.S.A. please write or call for shipping charges

You Can Pay By:
★ VISA or MasterCard
★ Or send check or money order payable in U.S. funds

Metric Industries Inc.
P.O. Box 42396
Cincinnati, OH 45242

(513) 677-0796

are moved on a byte-for-byte basis, this routine can be used in PMODE 3 or 4.

The PCOPY routine (lines 2700 through 2770) at $6A00 copies all graphics from pages 5 through 8 to pages 1 through 4, two bytes at a time, and can be used with PMODE 3 or 4.

Routine R9 (lines 2790 through 2990) at $6B00 copies a half-width image produced by R2 or R12 to both sides of graphics pages 5 through 8. R10 (lines 3010 through 3090) at $6C00 copies a half-height image produced by R1 or R11 to the top and bottom of graphics pages 5 through 8. Both R9 and R10 work in either PMODE.

Routine R11 (lines 3110 through 3290) at $7100 marks the beginning of the routines used solely for PMODE 3 pictures. This routine reduces a picture to one-half its height, but unlike the R1 routine for PMODE 4 it merely copies every other row. You can try using R1 in place of R11 to modify your picture and see which routine works better.

R12 (lines 3310 through 3700) at $7200 reduces a picture to one-half its width by using every other nibble (two bits) in two consecutive bytes. The resulting byte is kept in a location called TEMP. The first graphics byte is stored in both Register A and Register B. Register B is then ANDed with 192 (128+64=192) to get the first color value that is then stored in TEMP. Register A is ANDed with 12 (8+4=12), shifted to the left twice, and then added to TEMP (lines 3420 through 3460). This puts the third color value in the original byte as the second color value in TEMP. Registers A and B are loaded with the next graphics byte, and again Register B is ANDed with 192. Moving four shifts to the right and adding the value to TEMP (lines 3490 through 3550) makes this color value the third value in TEMP.

Next AND Register A with 12, shift it twice to the right, and add to it the contents of TEMP (lines 3560 through 3590). This puts the final color value as the fourth color value in Register A. This routine continues until the entire picture is reduced to half its width.

The next routine, R14 (lines 3720 through 4220) at $7400, flips a picture along the vertical axis. Not only each byte, but each nibble within that byte must be reversed. Again TEMP is used to store the partial results. Load registers A and B with the first graphics byte. AND Register A with 192 to get the first color value, then shift to the right six times and store the result in TEMP as the fourth color value (lines 380 through 390). Next AND the original value with 48 (32+16=48), shift to the right twice and add to TEMP as the third color value (lines 3920 through 3960). Now AND the original value with 12, shift to the left twice and add to TEMP as the second color value (lines 3980 through 4020). Finally, AND the original value with 3 (2+1=3), shift to the right six times and add the result with TEMP as the first color value (lines 4030 through 4100). Store this in the upper-right graphics corner of Page 5. Continue with the routine until the entire picture is rotated.

Press any key and enter 9 for a different four-corner mirror image. You can keep mirroring the image, but it starts to lose detail as the image becomes smaller.

R15 (lines 4240 through 4780) at $7500 mirrors the image from left and right. It is the same as the previous routine except Register Y is loaded with the upper-left graphics location of Page 5. The original byte is stored in the upper-left corner and the reversed byte is stored in the upper-right corner.

Up and Running

First type in the machine language program, Listing 1. When it's complete, check for errors by entering A/NO/NS/WE; when the program is error-free, assemble it with A MODIFY.BIN /NS. Next type in the BASIC program, Listing 2, and save it to disk as DOMODIFY.

As an example, we'll use the picture we saved in "The Assembly Line — Part I" as SCALEMAN.PIX. Run the BASIC program. Insert the disk with the picture in any drive and press ENTER. Then, as requested, type the PMODE value and press ENTER. Next type SCALEMAN.PIX and press ENTER. Select Drive 0 and press ENTER.

When the picture is loaded, press any key to get to the menu. Try entering 4 to see the picture reduced to the left-half of the screen. Press any key and then enter 1; now the picture is one-fourth of its original size in the upper-left corner of the screen. Press any key and enter 11 to restore the image. Press any key and enter 9 for a four-corner mirror image. You can flip the picture before selecting the mirror image for a different effect. For example, press any key and enter 11; press any key and enter 7; and press any key and enter 9 for a different four-corner mirror image. You can keep mirroring the image, but it starts to lose detail as the image becomes smaller.

Go back to the original picture with Option 11 and enter 12 to switch PMODEs. Even without a color monitor you can see the artifact colors. Now try Option 9. Where are all the colors? Since the PMODE 4 half-width routine combines nibbles into one color bit, we lose any artifact coloring. Go back to the original picture and switch PMODEs. Now enter Option 9 and enter 12 to switch to PMODE 4. There are the artifact colors — a real example of serendipity.

Try loading other PMODE 4 or 3 pictures, modify them as you want, and then save them to disk as follows:

```
SAVE "filename.ext",&H0E00,&H25F
F,&HA027
```

You can load those pictures and in turn modify them. Feel free to make any changes in the machine language program. ❑

64K Disk

Listing 1: MODIFY

```
00100 *MODIFY
00110          ORG     $6100
00120 R1       LDX     #$E00
00130          LDU     #$2600
00140          CLRA
00150 R1L1     STA     DOWN
00160          CLRB
00170 R1L2     STB     ACROSS
00180          LDA     32,X
00190          LDB     ,X+
00200          PSHS    B
00210          ORA     ,S+
00220          STA     ,U+
00230          LDB     ACROSS
00240          INCB
00250          CMPB    #31
00260          BLS     R1L2
00270          LEAX    32,X
00280          LDA     DOWN
00290          ADDA    #2
00300          CMPA    #190
00310          BLS     R1L1
00320          LBRA    PCOPY
00330
00340          ORG     $6200
00350 R2       LDX     #$E00
00360          LDU     #$2600
00370          CLRA
00380 R2L1     STA     DOWN
00390          CLRB
00400 R2L2     STB     ACROSS
00410          CLRB
00420 TEST1    LDA     ,X+
00430          BITA    #192
```

```
00440          BEQ     TEST2
00450          ADDB    #128
00460 TEST2    BITA    #48
00470          BEQ     TEST3
00480          ADDB    #64
00490 TEST3    BITA    #12
00500          BEQ     TEST4
00510          ADDB    #32
00520 TEST4    BITA    #3
00530          BEQ     NTEST
00540          ADDB    #16
00550 NTEST    LDA     ,X+
00560          BITA    #192
00570          BEQ     TEST5
00580          ADDB    #8
00590 TEST5    BITA    #48
00600          BEQ     TEST6
00610          ADDB    #4
00620 TEST6    BITA    #12
00630          BEQ     TEST7
00640          ADDB    #2
00650 TEST7    BITA    #3
00660          BEQ     FTEST
00670          INCB
00680 FTEST    STB     ,U+
00690          LDB     ACROSS
00700          INCB
00710          CMPB    #15
00720          BLS     R2L2
00730          LEAU    16,U
00740          LDA     DOWN
00750          INCA
00760          CMPA    #191
00770          BLS     R2L1
00780          LBRA    PCOPY
00790
00800          ORG     $6300
00810 R3       LDX     #$E00
00820          LDU     #$3DE0
00830          CLRA
00840 R3L1     STA     DOWN
00850          CLRB
00860 R3L2     STB     ACROSS
00870          LDA     ,X+
00880          STA     ,U+
00890          LDB     ACROSS
00900          INCB
00910          CMPB    #31
00920          BLS     R3L2
00930          LEAU    -64,U
00940          LDA     DOWN
00950          INCA
00960          CMPA    #191
00970          BLS     R3L1
00980          LBRA    PCOPY
00990
01000          ORG     $6400
01010 R4       LDX     #$E00
01020          LDU     #$261F
01030          CLRA
01040 R4L1     STA     DOWN
01050          CLRB
01060 R4L2     STB     ACROSS
01070          CLRB
01080 T1       LDA     ,X+
01090          BEQ     FT
01100          BITA    #128
01110          BEQ     T2
01120          INCB
01130 T2       BITA    #64
01140          BEQ     T3
01150          ADDB    #2
01160 T3       BITA    #32
01170          BEQ     T4
01180          ADDB    #4
01190 T4       BITA    #16
01200          BEQ     T5
01210          ADDB    #8
01220 T5       BITA    #8
01230          BEQ     T6
01240          ADDB    #16
01250 T6       BITA    #4
01260          BEQ     T7
01270          ADDB    #32
01280 T7       BITA    #2
01290          BEQ     T8
01300          ADDB    #64
01310 T8       BITA    #1
01320          BEQ     FT
01330          ADDB    #128
01340 FT       STB     ,U
01350          LEAU    -1,U
01360          LDB     ACROSS
01370          INCB
01380          CMPB    #31
01390          BLS     R4L2
01400          LEAU    64,U
01410          LDA     DOWN
01420          INCA
01430          CMPA    #191
01440          BLS     R4L1
01450          LBRA    PCOPY
01460
01470          ORG     $6500
01480 R5       LDX     #$E00
01490          LDY     #$2600
01500          LDU     #$261F
01510          CLRA
01520 R5L1     STA     DOWN
01530          CLRB
01540 R5L2     STB     ACROSS
01550          CLRB
01560 TT1      LDA     ,X+
01570          BEQ     FTT
01580          BITA    #128
01590          BEQ     TT2
01600          INCB
01610 TT2      BITA    #64
01620          BEQ     TT3
01630          ADDB    #2
01640 TT3      BITA    #32
01650          BEQ     TT4
01660          ADDB    #4
01670 TT4      BITA    #16
01680          BEQ     TT5
01690          ADDB    #8
01700 TT5      BITA    #8
01710          BEQ     TT6
01720          ADDB    #16
01730 TT6      BITA    #4
01740          BEQ     TT7
01750          ADDB    #32
01760 TT7      BITA    #2
01770          BEQ     TT8
01780          ADDB    #64
01790 TT8      BITA    #1
01800          BEQ     FTT
01810          ADDB    #128
01820 FTT      STB     ,U
01830          STA     ,Y+
01840          LEAU    -1,U
01850          LDB     ACROSS
01860          INCB
01870          CMPB    #15
01880          BLS     R5L2
01890          LEAX    16,X
01900          LEAY    16,Y
01910          LEAU    48,U
01920          LDA     DOWN
01930          INCA
01940          CMPA    #191
01950          BLS     R5L1
01960          LBRA    PCOPY
01970
```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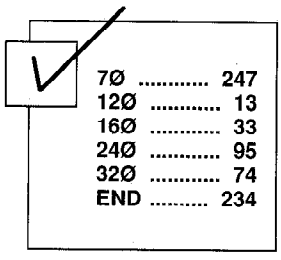
```
01980          ORG     $6600
01990 R6       LDX     #$E00
02000          LDY     #$2600
02010          LDU     #$3DE0
02020          CLRA
02030 R6L1     STA     DOWN
02040          CLRB
02050 R6L2     STB     ACROSS
02060          LDA     ,X+
02070          STA     ,Y+
02080          STA     ,U+
02090          LDB     ACROSS
02100          INCB
02110          CMPB    #31
02120          BLS     R6L2
02130          LEAU    -64,U
02140          LDA     DOWN
02150          INCA
02160          CMPA    #95
02170          BLS     R6L1
02180          LBRA    PCOPY
02190
02200          ORG     $6700
02210 SAVE     LDX     #$E00
02220          LDU     #$8000
02230          ORCC    #$50
02240 SAVE1    LDD     ,X++
02250          CLR     $FFDF
02260          STD     ,U++
02270          CLR     $FFDF
02280          CMPX    #$2600
02290          BLO     SAVE1
02300          ANDCC   #$AF
02310          RTS
02320
02330          ORG     $6800
02340 SHOW     LDX     #$E00
02350          LDU     #$8000
02360          ORCC    #$50
02370 SHOW1    CLR     $FFDF
02380          LDD     ,U++
02390          CLR     $FFDE
02400          STD     ,X++
02410          CMPX    #$2600
02420          BLO     SHOW1
02430          ANDCC   #$AF
02440          RTS
02450
02460          ORG     $6900
02470 R7       LDX     #$E00
02480          LDU     #$2600
02490          CLRA
02500 R7L1     STA     DOWN
02510          CLRB
02520 R7L2     STB     ACROSS
02530          LDA     ,X+
02540          STA     3088,U
02550          STA     3072,U
02560          STA     16,U
02570          STA     ,U+
02580          LDB     ACROSS
02590          INCB
02600          CMPB    #15
02610          BLS     R7L2
02620          LEAX    16,X
02630          LEAU    16,U
02640          LDA     DOWN
02650          INCA
02660          CMPA    #95
02670          BLS     R7L1
02680          LBRA    PCOPY
02690
02700          ORG     $6A00
02710 PCOPY    LDX     #$2600
02720          LDU     #$E00
02730 PCOPY1   LDD     ,X++
02740          STD     ,U++
02750          CMPU    #$2600
02760          BLO     PCOPY1
02770          RTS
02780
02790          ORG     $6B00
02800 R9       LDX     #$E00
02810          LDU     #$2600
02820          CLRA
02830 R9L1     STA     DOWN
02840          CLRB
02850 R9L2     STB     ACROSS
02860          LDA     ,X+
02870          STA     16,U
02880          STA     ,U+
02890          LDB     ACROSS
02900          INCB
02910          CMPB    #15
02920          BLS     R9L2
02930          LEAX    16,X
02940          LEAU    16,U
02950          LDA     DOWN
02960          INCA
02970          CMPA    #191
02980          BLS     R9L1
02990          LBRA    PCOPY
03000
03010          ORG     $6C00
03020 R10      LDX     #$E00
03030          LDU     #$2600
03040 R10L1    LDD     ,X++
03050          STD     3072,U
03060          STD     ,U++
03070          CMPX    #$1A00
03080          BLO     R10L1
03090          LBRA    PCOPY
03100
03110          ORG     $7100
03120 R11      LDX     #$E00
03130          LDU     #$2600
03140          CLRA
03150 R11L1    STA     DOWN
03160          CLRB
03170 R11L2    STB     ACROSS
03180          LDA     ,X+
03190          STA     ,U+
03200          LDB     ACROSS
03210          INCB
03220          CMPB    #31
03230          BLS     R11L2
03240          LEAX    32,X
03250          LDA     DOWN
03260          ADDA    #2
03270          CMPA    #190
03280          BLS     R11L1
03290          LBRA    PCOPY
03300
03310          ORG     $7200
03320 R12      LDX     #$E00
03330          LDU     #$2600
03340          CLRA
03350 R12L1    STA     DOWN
03360          CLRB
03370 R12L2    STB     ACROSS
03380          LDA     ,X+
03390          TFR     A,B
03400          ANDB    #192
03410          STB     TEMP
03420          ANDA    #12
03430          LSLA
03440          LSLA
03450          ADDA    TEMP
03460          STA     TEMP
03470          LDA     ,X+
03480          TFR     A,B
03490          ANDB    #192
03500          LSRB
03510          LSRB
03520          LSRB
03530          LSRB
03540          ADDB    TEMP
03550          STB     TEMP
03560          ANDA    #12
03570          LSRA
03580          LSRA
03590          ADDA    TEMP
03600          STA     ,U+
03610          LDB     ACROSS
03620          INCB
03630          CMPB    #15
03640          BLS     R12L2
03650          LEAU    16,U
03660          LDA     DOWN
03670          INCA
03680          CMPA    #191
03690          BLS     R12L1
03700          LBRA    PCOPY
03710
03720          ORG     $7400
03730 R14      LDX     #$E00
03740          LDU     #$261F
03750          CLRA
03760 R14L1    STA     DOWN
03770          CLRB
03780 R14L2    STB     ACROSS
03790          CLRB
03800          LDA     ,X+
03810          BEQ     R14L3
03820          TFR     A,B
03830          ANDA    #192
03840          LSRA
03850          LSRA
03860          LSRA
03870          LSRA
03880          LSRA
03890          LSRA
03900          STA     TEMP
03910          TFR     B,A
03920          ANDA    #48
03930          LSRA
03940          LSRA
03950          ADDA    TEMP
03960          STA     TEMP
03970          TFR     B,A
03980          ANDA    #12
03990          LSLA
04000          LSLA
04010          ADDA    TEMP
04020          STA     TEMP
04030          ANDB    #3
04040          LSLB
04050          LSLB
04060          LSLB
04070          LSLB
04080          LSLB
04090          LSLB
04100          ADDB    TEMP
04110 R14L3    STB     ,U
04120          LEAU    -1,U
04130          LDB     ACROSS
04140          INCB
04150          CMPB    #31
04160          BLS     R14L2
04170          LEAU    64,U
04180          LDA     DOWN
04190          INCA
04200          CMPA    #191
04210          BLS     R14L1
04220          LBRA    PCOPY
04230
04240          ORG     $7500
04250 R15      LDX     #$E00
04260          LDY     #$2600
04270          LDU     #$261F
04280          CLRA
```

```
04290 R15L1   STA     DOWN
04300         CLRB
04310 R15L2   STB     ACROSS
04320         CLRB
04330         LDA     ,X+
04340         STA     ,Y+
04350         BEQ     R15L3
04360         TFR     A,B
04370         ANDA    #192
04380         LSRA
04390         LSRA
04400         LSRA
04410         LSRA
04420         LSRA
04430         LSRA
04440         STA     TEMP
04450         TFR     B,A
04460         ANDA    #48
04470         LSRA
04480         LSRA
04490         ADDA    TEMP
04500         STA     TEMP
04510         TFR     B,A
04520         ANDA    #12
04530         LSLA
04540         LSLA
04550         ADDA    TEMP
04560         STA     TEMP
04570         ANDB    #3
04580         LSLB
04590         LSLB
04600         LSLB
04610         LSLB
04620         LSLB
04630         LSLB
04640         ADDB    TEMP
04650 R15L3   STB     ,U
04660         LEAU    -1,U
04670         LDB     ACROSS
04680         INCB
04690         CMPB    #15
04700         BLS     R15L2
04710         LEAX    16,X
04720         LEAY    16,Y
04730         LEAU    48,U
04740         LDA     DOWN
04750         INCA
04760         CMPA    #191
04770         BLS     R15L1
04780         LBRA    PCOPY
04790
04800 TEMP    RMB     1
04810 DOWN    RMB     1
04820 ACROSS  RMB     1
04830         END     R1
```



Listing 2: DOMODIFY

```
0 'COPYRIGHT 1990, FALSOFT INC.
10 IF PEEK(&H6100)<>142 THEN LOA
DM"MODIFY"
20 PCLEAR 8:CLEAR 200,&H6100-1
30 CLS:PRINT:PRINT"INSERT DISK W
ITH PICTURE IN ANY   DRIVE THEN
PRESS ANY KEY...":EXEC &HADFB
40 PRINT:INPUT"PMODE (3,4)  -";P
M:IF PM<3 OR PM>4 THEN 40
50 INPUT"FILENAME.EXT -";NM$:IF
LEN(NM$)>12 THEN 50
60 INPUT"DRIVE #(0-4) -";DR$:IF
VAL(DR$)<0 OR VAL(DR$)>4 THEN 60
70 PMODE PM,1:PCLS:SCREEN1,1:LOA
DM NM$+":"+DR$
80 EXEC&HADFB
90 EXEC &H6700
100 CLS:PRINTTAB(8)"PICTURE OPTI
ONS"
110 PRINT" 1> HALF HEIGHT",," 2>
 MIRROR TOP/BOTTOM"," 3> COPY TO
P/BOTTOM"," 4> HALF WIDTH",," 5>
 MIRROR LEFT/RIGHT"," 6> COPY LE
FT/RIGHT"," 7> FLIP TOP/BOTTOM",
" 8> FLIP LEFT/RIGHT"," 9> MIRRO
R FOUR CORNERS","10> COPY FOUR C
ORNERS"
120 PRINT"11> BACK TO ORIGINAL",
"12> SWITCH PMODE":PRINT:LINEINP
UT"ENTER DESIRED OPTION (1-12)?
";Q$:Q=VAL(Q$):IF Q<1 OR Q>12 TH
EN 100
130 IF PM=3 THEN ON Q GOTO 260,3
30,270,280,320,290,300,310,340,3
50,360,370
140 ON Q GOTO 150,220,160,170,21
0,180,190,200,230,250,240,370
150 PMODE4,5:PCLS:EXEC &H6100:GO
TO 380
160 EXEC &H6100:EXEC &H6C00:GOTO
 380
170 PMODE4,5:PCLS:EXEC &H6200:GO
TO 380
180 EXEC &H6200:EXEC &H6B00:GOTO
 380
190 EXEC &H6300:GOTO 380
200 EXEC &H6400:GOTO 380
210 EXEC &H6200:EXEC &H6500:GOTO
 380
220 EXEC &H6100:EXEC &H6600:GOTO
 380
230 EXEC &H6200:EXEC &H6500:EXEC
 &H6100:EXEC &H6600:GOTO 380
240 EXEC &H6800:GOTO 380
250 EXEC &H6100:EXEC &H6200:EXEC
 &H6900:GOTO 380
260 PMODE3,5:PCLS:EXEC &H7100:GO
TO 380
270 EXEC &H7100:EXEC &H6C00:GOTO
 380
280 PMODE3,5:PCLS:EXEC &H7200:GO
TO 380
290 EXEC &H7200:EXEC &H6B00:GOTO
 380
300 EXEC &H6300:GOTO 380
310 EXEC &H7400:GOTO 380
320 EXEC &H7200:EXEC &H7500:GOTO
 380
330 EXEC &H7100:EXEC &H6600:GOTO
 380
340 EXEC &H7200:EXEC &H7500:EXEC
 &H7100:EXEC &H6600:GOTO 380
350 EXEC &H7100:EXEC &H7200:EXEC
 &H6900:GOTO 380
360 EXEC &H6800:GOTO 380
370 PM=(PM AND 1)+3
380 PMODE PM,1:SCREEN 1
390 EXEC &HADFB
400 GOTO 100
```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Epson FX-850 Dot-Matrix	365.00
Epson LQ-510 Dot-Matrix	345.00
Epson LQ-850 Dot-Matrix	585.00
Epson FX-1050 Dot-Matrix	485.00
Panaonic KX-P1180 Dot-Matrix	195.00
Panasonic KX-P1191 Dot-Matrix	265.00
Panasonic KX-P1124 Dot-Matrix	329.00

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An important link in the CoCo community is its ability to communicate with fellow users. If questions arise, a fresh source of information can be invaluable. We here at THE RAINBOW have decided to create "Intercom," an information exchange point for Pen Pals, CoCo Clubs and BBSs.

If you would like a Pen Pal or are running a CoCo Club or BBS, send us a letter including the information listed here to: The Rainbow Intercom, P.O. Box 385, Prospect, KY 40059.

Only those parties who have signed our non-piracy "agreement form" appear in listings of Intercom. Also, please notify us if you want to add or delete any names on this list.

Pen Pals

• I have a CoCo 3 (512K), FD-500 dual disk drives, DMP-105 and a modem. I am 51 years old and enjoy communicating with people about the CoCo or life in general. I will return all letters sent to me either via hard copy or letters on disk in BASIC format.

Edward G. Russell
192 Stadium Park
Key West, FL 33040

• I have a CoCo 3, FD-501 drive and a DMP-106 printer. I would enjoy pen pals from anywhere in the world. I am 28 years old. I will answer all letters.

Richard Butler
702 North Cass
Mount Ayr, IA 50854

• I am 25 years old and I'm a physical therapist. I would like to contact people who are interested in working with the handicapped.

Newton Luiz Nickel
Dias da Rocha Filho, 39 apt.:04
Curitiba, Parana, Brazil 80040

• I am interested in having a pen friend with a CoCo 3. This person should be able to help teach German and/or be from West Germany. I would like to correspond with someone who knows and understands how to apply mathematical functions such as sin, cos, tan, etc... in graphics applications.

Fred J. Slagle
1900 Boatmans Ridge Rd.
Morristown, TN 37814

• I'm 15 and have a CoCo 3, CoCo 2, DMP-130, FD-502 and a CCR-81 cassette recorder. I like most games, but my favorites are Adventures. I am looking for pen pals for the exchange of ideas and CoCo information. I will answer all letters. No age limits.

Alan Leboff
519 Highland Ave.
Malden, MA 02148

• I am 14 and would like pen pals from all over the world. I have a CoCo 2, FD-502 disk drive, DCM-6 modem and a Gemini 10X printer. I enjoy using CoCo and Nintendo. My other interests are electronics, AD&D and forming a BBS.

Richard Melnick
P.O. Box 1620
Greenwood, N.S.
B0P 1N0
Canada

• I live in Argentina, I'm 15 years old, and I have a CoCo 2, one disk drive, a DMP-105 and a CCR-81 cassette recorder. I love Adventure games and astronomy studies. I want to exchange letters of any theme, with pen pals of my age from the United States. I'll try to answer all letters.

Raul Eduardo Gonzalez
1224 Maestro Vidal Ave.
B Los Platanos 5010
Cordoba, Argentina

• I am 17 years old and have a Dragon 64 (nearly identical to CoCo 1 and 2) disk drive and OS-9. I would like to get in touch with CoCo and Dragon users all over the world. My particular interests are music, programming and all games.

Ola Eldoy
Stokken
N-5410 Sagvag
Norway

• I am 16 years old and looking for pen pals anywhere. I have a 128K CoCo 3, disk drive and cassette recorder. I love games and Adventures.

Robert A. Young
Birch Hill Farms
Hwy #9, RR2
Mildmay, ON N0G 2J0
Canada

CoCo Clubs

ARIZONA

✦Tucson Color Computer Club, Bruce Smith, 3030 Mustang Dr., Tucson, 85708, (602) 747-7859

CALIFORNIA

✦Citrus Color Computer Club, Orville Beaver, P.O. Box 6991, San Bernardino, 92412-6991, (714) 685-6334

✦Color America Users Groups, Jack W. Eizenga, 3811 N. Foster Ave., Baldwin Park, 91706-3912, (818) 960-8010

✦Marysville\Yuba City Area CoCo Club, Jim Vestal, P.O. Box 5126, Marysville, 95901, (916) 742-5499

CONNECTICUT

✦South Eastern Connecticut Color Computer Users Group, Larry Donovan, 25 Stony Brook Rd., Stonington, 06378, (203) 535-4211

FLORIDA

✦Cross-Country Color Computer Club, Tom Tittle, 860 Gardenia Dr., Royal Palm Beach, 33411, (407) 798-3726

GEORGIA

✦Atlanta Computer Society, Inc., Alan R. Dages, 4290 Bells Ferry Rd. Suite 10639, Kennesaw, 30144, (404) 469-5111(voice), (404) 636-2991(modem)

IDAHO

✦Snake River Color Computer Club, Emil Franklin, 1750 Carmel Dr., Idaho Falls, 83403, (208) 522-0220

ILLINIOS

✦Chicago OS-9 Users Group, Roger C. Halvorsen, 1598 Ardmore Ave., Glendale Heights, 60139, (708) 469-8174

✦Cook County Color Computer Club, Howard Luckey, 10 McCarthy Rd., Park Forest, 60466-2122, (708) 747-0117

✦Motorola Micro Computer Club, Steve Adler, 1301 East Algonquin Rd., Shaumburg, 60196, (708) 576-3044

✦Quincy Color Computer Club, Steve Wellman, 1600 Highland Lane, Quincy, 62301, (217) 224-8307

✦Starved Rock Color Computer Club, Neal Roberts, 1250 E. Bluff, Marseilles, 61341, (815) 795-4894

IOWA

✦Metro Area Color Computer Club, Joe Cavallaro, 2425 Ave. A, Co. Bluffs, 51501, (712) 322-2438

✦Mid Iowa CoCo, Terry Simons, 1328 48th, Des Moines, 50311, (515) 279-2576

LOUISIANA

✦The CoCo Sig, Christopher Mayeux, 20 Gibbs Dr., Chalmette, 70043, (504) 277-6880(voice) or (504) 277-5135(modem)

MARYLAND

✦Arkade, John M. Beck, 3513 Terrace Dr. #D, Suitland, 20746, (301) 423-8418

MICHIGAN

✦Color Computer Owners Group, Bernard A. Patton, 388 Emmons Blvd., Wyandotte, 48192, (313) 283-2474

✦Greater Lansing Color Computer Users Group, E. Dale Knepper, P.O. Box 14114, Lansing, 48901, (517) 626-6917

NEW YORK

✦The Island CoCo Club, Dennis Zobel, P.O. Box 426, Massapequa, 11762

✦Kings Byte CoCo Club, Morty Libowitz, 1063 E. 84th St., Brooklyn, 11236, (718) 763-4233

NORTH CAROLINA
✦Norca Users Group, Matthew Royal, Rt. 21 Box 906, Fayetteville, 28304, (919) 484-1230

OHIO
✦Dayton Area Color Computer Users Group, John Teague, 308 Orangewood Dr., Kettering, 45429, (513) 434-9168
✦Dayton Color Computer Users Group, Steven E. Lewis, 4230 Cordell Dr., Dayton, 45439, (513) 299-3060
✦The Greater Toledo Color Computer Club, Bill Espen, 1319 North St., Bowling Green, 43402, (419) 471-9444
✦Tri County Computer User Group, Ron Potter, 10914 Oliver Rd., Cleveland, 44111, (216) 476-2687

PENNSYLVANIA
✦Cumberland Valley Users Group, Thomas Martin, 9085 Newburg Rd., Newburg, 17240, (717) 423-5525
✦Pittsburgh Color Group, Ralph Marting, 309 Frazier Dr., Pittsburgh, 15235, (412) 823-7607

RHODE ISLAND
✦New England "CoCoNuts" Color Computer Club, Arthur J. Mendonca, P.O. Box 28106 North Station, Providence, 02908, (401) 272-5096(Sig3)

SOUTH CAROLINA
✦Spartanburg CoCo Club, Jesse W. Parris, 152 Bon Air Ave., Spartanburg, 29303, (803) 573-9881

SOUTH DAKOTA
✦Empire Area Color Computer Users Group of South Dakota, Carl Holt, P.O. Box 395, Brandon, 57005, (605) 582-3862

TEXAS
✦The Codis CoCo Symphony, William C. Garretson, 2902 Harvard St., Irving, 75062, (214) 570-0823
✦Mid Cities TRS-80 Users Group, Rob Yoder, P.O. Box 171566, Arlington, 76003, (817) 535-7931

VIRGINIA
✦Richmond Area Color Computer Organization, William T. Mays Jr., 6003 Westbourne Dr., Richmond, 23230, (804) 282-7778
✦Southwestern Virginia Color Computing Club, Ricky Sutphin, Route 1 Box 20, Henry, 24102, (703) 365-2018

WASHINGTON
✦Spokane Color Computer Club, Richard Baysinger, W. 2217 Sanson, Spokane, 99205, (509) 326-2793 or BBS#(509) 325-6787

WEST VIRGINIA
✦Huntington Area Color Computer Symposium, Jim Bush, P.O. Box 391, Lesage, 25537-0391, (304) 736-5314

AUSTRALIA
✦Australian National OS-9 Users Group, Gordon Bentzen, C/- 8 Odin Street, Sunnybank, Queensland, 4109, (07) 345-5141
✦Brisbane Southwest Colour Computer Users Group, Bob Devries, 21 Virgo St., Inala, Queensland, 4077, (61)-7-3727816

CANADA
✦Halifax Dartmouth Color Computer Users Group, David H. Haley, Comp. #7 Greenforest Subdivision, RR#1 Lower Sackville, Nova Scotia, B4C 2S6, (902) 864-0454
✦Les CoCophiles Du Sud-Ouest, Jean Labrose, 20 Ste-Julie #A, Vaudreuil, Quebec, J7V 1B5, (514) 455-0486

PUERTO RICO
✦Puerto Rico Color Computer Club, Luis R. Martinez, P.O. Box 2072, Guaynabo, 00657-7004, (809) 799-8217 or (809) 728-2314

BBSs

State/City	BBS Name	Access Number	Parameters (Baud rate-Parity-Word Bits-Stop Bits)	SysOp
Arizona				
Peach Orchard	Comm. Central BBS HST	(501)249-3814	300/19,200-N-8-1	Perry Parsons
California				
Marysville	09-Online BBS	(916)742-6809	300/1200-N-8-1	Jim Vestal
Colorado				
Colorado Springs	The Time Safari	(719)635-7228	300/1200-N-8-1	David Vallier
Florida				
Miami	A Little R S R	(305)266-1099	300/1200-N-8-1	Robert Jones/Robert Caraballo
Kansas				
Beloit	Kansas Konnektion BBS[1]	(913)738-5613	300/1200-N-8-1	Gary N. McCarty
Massachusetts				
Worcester	Gosub BBS	(508)756-1442	300/1200/2400-N-8-1	Richard Bostock
Michigan				
Taylor	J & L's CoCo Corner	(313)292-4713	300/1200/2400-N-8-1	Jim Snider
Minnesota				
Brainerd	Brainerd 4-Way[2]	(218)828-1144	300/1200/2400-N-8-1	Mike Lowe
New Hampshire				
Allenstown	The CoCoBean BBS	(603)485-8682	300/1200/2400-N-8-1	David Bean
New Jersey				
High Bridge	Hilltop BBS	(201)638-5698	300/1200/2400-N-8-1	Guy Silliman
Mercerville	TAO BBS	(609)587-2672	300/1200/2400-N-8-1	Bob Watson
Ohio				
Bellaire	The Phantasm BBS	(614)676-2505	300/1200/2400/9600-N-8-1	Dave Roth
Oklahoma				
Tecumseh	Pat BBS[3]	(405)598-5082	300-N-8-1	Pat Aldridge
Pennsylvania				
Johnstown	CoCo Electronic BBS[4]	(814)535-1497	300/1200/2400-N-8-1	Albert Baldish
Palmer	ASCII =80=	(215)252-1608	300/1200/2400-E-7-1	Nevin Keller
Tennessee				
South Pittsburg	Base-Net BBS	(615)837-8352	300/1200/2400-N-8-1	Howard Bacon
Virginia				
Henry	Public Access[5]	(703)365-2018	300/1200-E-7-1 or N-8-1	Ricky Sutphin
Wisconsin				
Gays Mills	CoCo BBS	(608)735-4509	300/1200/2400-N-8-1	Robert & Daven Howard
Marshall	Madison Tandy Users BBS	(608)655-3806	300/1200/2400-N-8-1	Fran Selje
Canada				
Lunenburg, N.S.	Color Nova BBS	(902)634-3095	300/1200/2400-N-8-1	John D. Cleveland

Notes:
[1]Kansas Konnektion BBS is up from 10 p.m. to 7 a.m.
[2]Brainerd 4-Way is up from 8 p.m. Saturday to 5 p.m. Friday.
[3]Pat BBS is up 5 p.m. to 9 p.m. weekdays and 10 a.m. to 10 p.m. weekends. This new BBS is counting on you for uploads.
[4]CoCo Electronic BBS is up 8 p.m. to 6 a.m. seven days a week.
[5]Public Access is up from 12:30 a.m. to 9 a.m. Monday through Sunday.

OS-9 Uploads Growing

by Eddie Kuns
CoCo SIG Database Assistant

General Information (in the OS-9 SIG): Jim Sanford (WB4GCS) posted two articles: one about Delphi's online help facility, the other describing how to install the Tandy SmartWatch into the CoCo. **Brian White** (BRIANWHITE) contributed an archive of OS-9 SIG forum messages about the CoCo 4. **Paul Ward** (PKW) submitted changes and enhancements to *Start OS-9*. **Warren Moore** (WJMOORE) contributed a file of humorous business terms.

Applications: **Mike Sweet** (DODGECOLT) released Version 1.6 of the *Ed* word processor. This version fixes some bugs in Version 1.5, and is less than 16K. **Bernie Besherse** (PROA) posted a *DynaCalc* template to help keep track of your budget and checks. Paul Ward contributed a BASIC09 program to calculate studio room reverb times as a function of octave and surface treatment of the studio's walls. **Hugo Bueno** (MRGOOD) submitted the game *Scramble*. **John Barrett** (JBARRETT) posted a public-domain version of *Surveyor*, an application for civil engineers and surveyors.

Utilities: **Roger Krupski** (HARDWAREHACK) contributed a new `CC3Go` module for OS-9 Level II. This new version allows you to specify the parameters `CC3Go` passes to the initial shell. Jim Sanford submitted *Move*, a utility that moves a file to a different directory on the same disk. **Tim Fadden** (07ESRTIMOTHY) posted a new version of a spooling program suitable for installation in the `startup` file. RMA source is included. **Bruce Isted** (BRUCEISTED) gave us an updated version of Bob Santy's RS-DOS utility to transfer files between RS-DOS and OS-9 disks. **Jeff Blower** (SEBJMB) released a BASIC09 procedure that uses Pete Lyall's *HDKit* to make hard drive back-up and restoring a breeze yet simplifies the *HDKit* interface. **Zack Sessions** (ZACKSESSIONS) showed us a turbo-charged version of *SDir* (Super Directory). This version runs three to five times faster than the previous release. It offers all of the standard `dir` options plus many more. **Phil Zeigler** (PHILZEIGLER) contributed Vaughn Cato's program to unzip the new PKZIP-101 archives compressed in the implosion format. **Mike Huskey** (KINGTRENT) posted a replacement for `wcreate`. **Jay Truesdale** (JAYTRUESDALE) submitted a complete listing (current to December 1, 1989) of the utilities database, giving the complete description of each file. This list is uploaded in both the PAK and AR archive formats.

Device Drivers: Jay Truesdale sent a listing of the Device Drivers database.

Patches: The must-get of the month is the `IPatch` file (and accompanying bouncing ball demo) for `grfdrv`, released by **Kevin Darling** (KDARLING). This patch to the OS-9 windows graphics driver speeds operation in graphics windows up to 10 times. Mike Sweet posted a patch to this patched version of `grfdrv` to allow for 25-line text screens (not graphics windows) and a patch to *GShell+* Version 1.24A to allow it to take advantage of the speed of the patched `grfdrv`. Phil Zeigler released a new version of `CC3Go` that allows you to protect your OS-9 boot with a password.

Telecommunications: **Wayne Laird** (WAYNELAIRD) submitted a list of OS-9 BBSs. **Eddie Kuns** (EDDIEKUNS) released *KBCom* Version 1.0.0, a new terminal program for OS-9 that emulates the VT100 and VT52 terminals. **Bill Brady** (OS9UGED) released a faster version of `WPXMod`, Xmodem for *WizPro*. Jay Truesdale sent an archived directory listing for the Telcom database.

Graphics & Music: **Robert Louden** (KURSE) posted a GIF picture file of part of the Mandelbrot set. **Brian Wright** (POLTERGEIST) contributed a GIF picture of Seattle. **Mike Knudsen** (RAGTIMER) released Version 4.5.0-B of the *UltiMusE III* JukeBox CD Player, which fixes a bug in Release 4.5.0 that sticks you in a long play list. Brian Wright submitted a collection of MAC sound files. **Eric Stringer** (NES) posted three pictures produced by his new video digitizer, including one of the *Teenage Mutant Ninja Turtles*. **Doug Fraser** (LDF) contributed three Christmas hymns: "Angels We Have Heard on High," "O Come All Ye Faithful" and "What Child is This?" **Kelly Thompson** (KMTHOMPSON) submitted "Carol of the Bells," to be played with *UltiMusE*. **Paul Duncan** (PDUNC) posted a composition by Scarlatti. Brian White was busy this month. He released a *Star Trek* game, a screen saver program ported from UNIX and *Show*, a program that allows you to view BIN, MAC and VEF format pictures. *Show* is expandable and allows you to view pictures larger than one screen. **Mike Haaland** (MIKEHAALAND) contributed C routines for loading and saving Get/Put buffers with VEF and VEFSquash picture data. He also posted *DigiView* Version 1.3, a program to display DS-69 256-by-256 and 128-by-128, 16-level grey scale pictures. Doug Fraser submitted a musical rendition of Pachelbel's "Canon in D." Warren Moore contributed a humorous demo of BASIC09's Get/Put buffers.

Programmers Den: Zack Sessions released the latest version of Bob van der Poel's RMA assembler library. This version includes C-like string handling, numeric

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Eddie Kuns is pursuing a PhD in physics at Rutgers University. He lives in Aurora, Illinois and works as a programmer and researcher at Fermilab. Eddie is co-manager of the CoCo SIG; his username is EDDIEKUNS.

conversion, math and full documentation. **Glen Hathaway** (COMPER) posted an orbit program including C source.

68K-OS9: Jay Truesdale submitted a demo of D.P. Johnson's FORTH09/68000.

CoCo SIG

General Database: **Matt Royal** (THEREB) contributed a message downloaded from a BBS telling the tale of "The Modern Civil War."

CoCo 3 Graphics: **Tommie Taylor** (TOMMIETAYLOR) posted a *CoCo Max 3* picture of the CoCoNuts BBS in Fayetteville, North Carolina. **Joe Walker** (JDWALKER) submitted two demos of *SuperSound*. **Gerald Young** (THEVOYAGER) released an updated version of CDUMP16.ARC, a screen dump utility. **Donald Ricketts** (STEVEPDX) contributed several 640-format pictures of TV women including Paula Abdul and Farrah Fawcett. **Larry Moore** (LDMOORE) posted a collection of pictures from the *Strip Poker* game along with a utility to view them. **Randy Cassel** (BBTROLL) uploaded several digitized female teen heartthrobs including Debbi Gibson and Staci Keenan.

Utilities & Applications: **Bryan Stephens** (BRSTEPHENS) submitted *Ledger3*, a spreadsheet program for the CoCo 3. **Frances Calcraft** (FRANCALCRAFT) released an updated CoCo 3 monitor program that allows you to examine and alter memory. **Gary Nelson** (RAINMAN) contributed a machine-language program to print disk directory labels. Eric Stringer posted the newest version of Wayne Setzer's mailing list manager for the CoCo. This program keeps track of addresses and prints them out on labels. **James Woodward** (JIMWOOD) submitted a program to factor an integer into prime numbers.

Games: Eric Stringer contributed the newest version of *Robot Zap* for the CoCo 2 and 3. **Hank Walther** (COCOHAM) posted a BASIC program to move *Predator* to disk and run it.

Music and Graphics: Jim Pogue (JIMPOGUE) submitted an executable music file that plays "O Holy Night." Doug Fraser contributed a collection of *Lyra* music files. **Gary Poskocil** (GPOS) uploaded several Orchestra-90 Christmas carols including "Carol of the Bells" and "O Come All Ye Faithful."

Help: **Don Hutchison** (DONHUTCHISON) posted a file explaining the standards for uploading material to the databases in the CoCo SIG.

Product Reviews & Announcement: **Bren Stockdale** (BRENNERS) submitted a brief description of the new XPort interface from Orion Technologies.

Telecommunications: **Malcolm Heath** (MACHEATH) contributed a patch to allow all versions of *WEFAX* to use SCREEN 1,1. Wayne Laird uploaded a list of BBSs for the Color Computer.

*** EXTENDED * ADOS-3**

*** Built-in RAMdisk * Point-and-pick file select menu ***

Not a new version of ADOS-3, but a new product that shares space with ADOS-3 in a 16K EPROM. Arrow-key selection of files to execute, LOAD, COPY, KILL or SCAN. The BACKUP command is doubled in speed for full disks, proportionately faster for partly full disks. (BACKUPs to or from the RAMdisk typically take 5 to 20 sec.) • BACKUP-with-format • Wild-card COPY and KILL, with optional prompting for individual files • Date (or date/time with hardware clock) displayed for files in the directory, printed on LLISTings • DATE$ function • Key repeat • Block move/copy of BASIC program lines • Text screen printer dump • Auto-reboot of a BASIC program or the DOS command • Parallel printing • Read/write/format 35/40 tracks on 80-track drives • Supports 3 double-sided drives plus 2 RAMdrives • Allows different numbers of tracks on different drives • Shares the original's excellent compatibility with commercial software. For 128K CoCo 3 with ADOS-3 (RAMdisk use requires 512K). Includes information on having an EPROM burned (cost is $15) after configuring Extended ADOS-3. Disk, **$39.95.** Extended ADOS-3 plus ADOS-3, **$64.95.** Driver for Disto real-time clock, **$5.** Adapter for controllers lacking 28-pin socket, **$10.** SmartWatch real-time clock (Tandy 25-1033 equiv.), **$35** (Drivers for Ext. ADOS-3 and OS-9 included; usable in 28-pin socketed controllers or in Rompack, **$10).**

"...will blow your socks off...impossible to give Extended ADOS-3 anything other than a rave review."
— Rainbow, October 1989.

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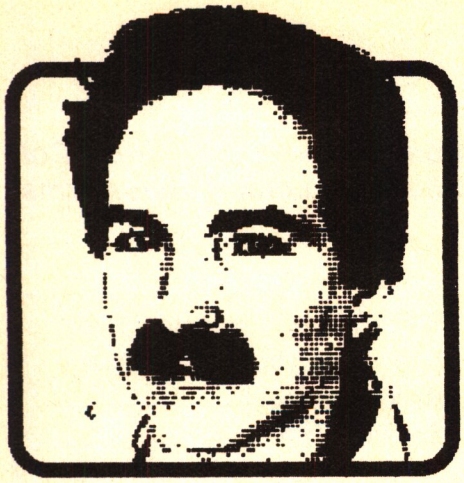

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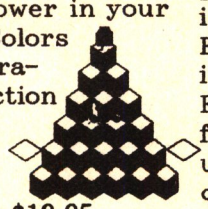
This is a fascinating CoCo 3 game of skill and coordination. Pyramix is 100% machine language written exclusively to take advantage of all the power in your 128K CoCo 3. The Colors are brilliant, the graphics sharp, the action fast. Written by Jordon Tsvetkoff and a product of ColorVenture. **Disk: $19.95**



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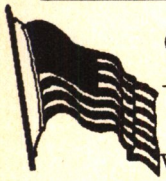

Vocal Freedom

Vocal Freedom turns your computer into a digital voice recorder. The optional Hacker's Pac lets you incorporate voices or sounds that you record into your own BASIC or ML programs. This is not a synthesizer. Sounds are digitized directly into computer memory so that voices or sound effects sound very natural. One "off-the-shelf" application for Vocal Freedom is an automatic message minder. Record a message for your family into memory. Set Vocal Freedom on automatic. When Vocal Freedom "hears" any noise in the room, it plays the prerecorded message directly from its Random Access Memory with amazing fidelity! You may also SAVE or LOAD sounds to and from DISK. VF also tests memory to take advantage of from 64K up to a full 512K. Requires low cost amplifier (RS cat. #277-1008) and any microphone. Will run on a CoCo 1, 2, or 3. Vocal Freedom **Disk: $34.95.** Optional Hacker's Pac **Disk: $19.95. Disk for both: $49.95**

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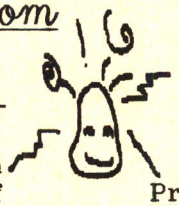

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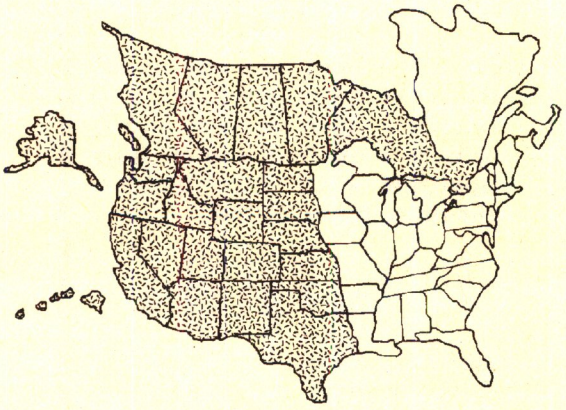

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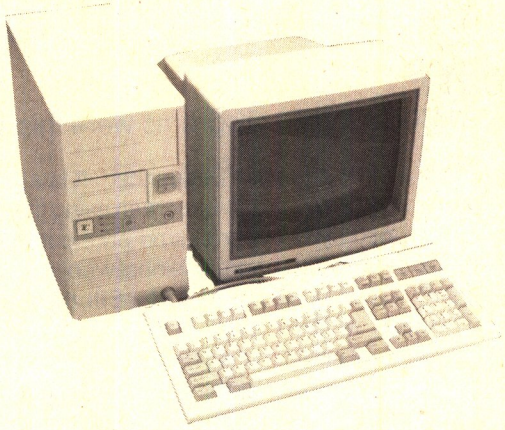

The **Tomcat** is a major improvement over the CoCo 3. The **Tomcat's TC9** 6809 CPU is over 25% faster! It uses a PC AT compatible keyboard, has two 'real' serial ports, supports a serial mouse, has a parallel printer port, has provision for 512K on board RAM or it can use a CoCo 3 512K memory upgrade, can be upgraded to 1 megabyte with the Disto 1 Meg upgrade with no soldering, it has 8 bit D to A and 8 bit A to D. 8 bit provides better sound and a higher resolution joystick, 256 verses 64, it supports an internal speaker, has the standard CoCo bus so that CoCo cartridges can be used (Disto, Eliminator, Burke&Burke Etc.), is powered by a PC style power supply. This also allows installing the board in most PC clone cases, will work with most, if not all OS9 software, will have RSDOS compatibility,and is K-Bus compatible! Whew!!!

K-Bus capability allows interfacing the **Tomcat** to the 68000 and even the 68030! By installing a 68000 CPU, the **Tomcat** becomes a dual-processing system! When in OS9 Level II mode the 68000 becomes a co-processor to the **Tomcat**, like a accelerator to Level II with a 2 or 3 fold improvement in performance!

When the 68000 is the master under OS9/68K, the **TC9** acts as a co-processor to 68K. Switching back and forth between systems will be easy and will allow a smooth transition from OS9 to OSK. It is not necessary to have OSK to get the benefits of the 68000, but it provides a smooth transition when and if you decide to make the move. You go at your own pace, upgrading as you desire, and at each point you get a significant improvement in performance, for a very slight cost.

Expansion

The world of 68K is open to you. The logical first step is to add a 68000 CPU which will immediately speed up Level II operations by several factors and opens the door to running OSK. No other additions are needed to run OSK, as OSK will run in the **TC9** memory and use **TC9** I/O. For further performance increases additional boards, memory, I/O etc. can be added to the **Tomcat**. It is even possible to have several **TC9**'s in the **Tomcat** for a multi-processing system! Memory limits are 16 Megabytes of which more than 14 Megabytes can be RAM! Because of the bus concept upgrades to future CPUs only requires adding that CPU to accomplish it. For example, you could start with a 68000 and later replace that with a 68030 and still use ALL of your other cards. When new cards such as the 68040 become available, you could add those too.

This is upgrading without having to throw anything away. Even if you eventually switched over to 68K completely the **TC9** still functions as a multi-function graphics co-processor. Because of the wide variety of K-Bus boards available and those under development, the possibilities for the future are unlimited. The **TC9 Tomcat** truly is the CoCo 4 that Tandy should have made, for that matter it could well be the CoCo 5, 6, 7, 8.....

Should you get one?

If you currently own a CoCo 3 and use it for either RSDOS or OS9 Level II the **TC9 Tomcat** is your road to the future. It will run your current software faster and give you powerful new features and performance at modest cost. You get the ability to expand at your own pace, at low cost, the way you want to do it, for your future.

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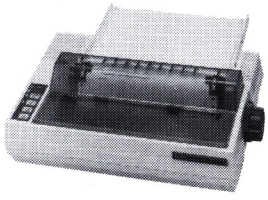

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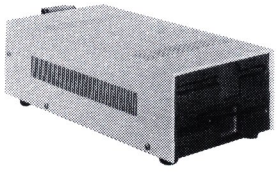

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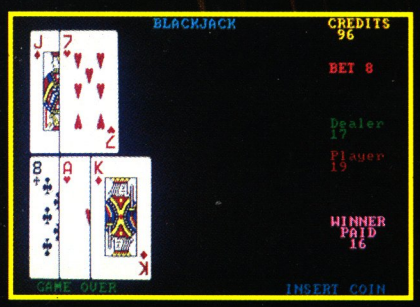

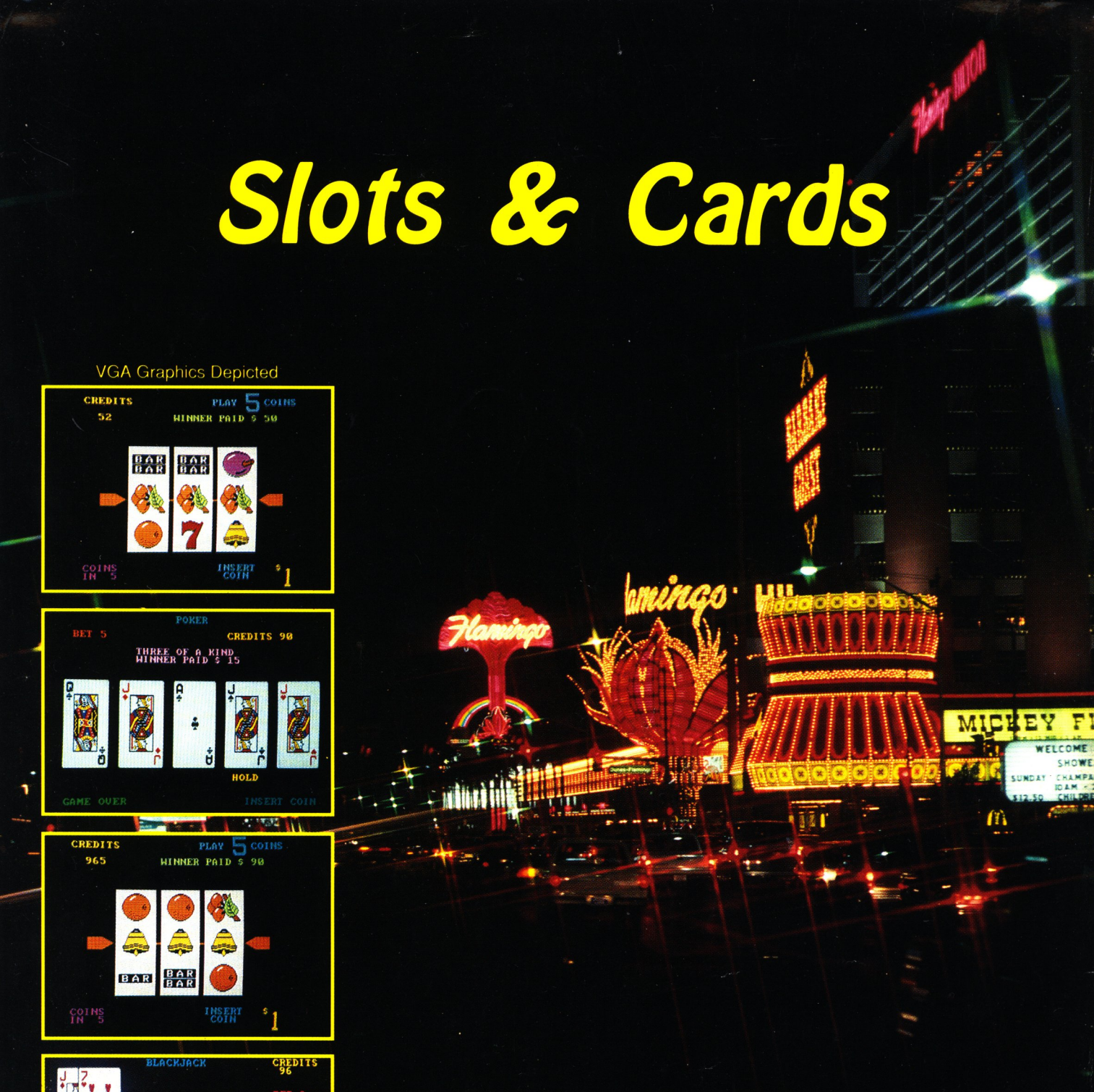

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